LJLA Airspace Transition

Options Development Step 2A

Document Details

Reference	Description
Document Title	LJLA Airspace Transition
	Options Development Step 2A
Document Ref	71137 056
Issue	Issue 4
Date	14th June 2019
Client Name	LJLA
Classification	

Issue	Amendment	Date
Issue 1	Initial	14th May 2019
Issue 2	Expansion of Section 1 to describe process by which Longlist was developed. This additional information was requested by CAA. Document title amended to 'Design Options Longlist (Images)'	22nd May 2019
Issue 3	Clarification of the criteria used in development of comprehensive list of options	29th May 2019
Issue 4	Further clarification of process by which the options were developed as requested by CAA. Document renamed to 'LJLA Options Development Step 2A'.	14th June 2019

Approval Level	Authority	Name
Author		
Reviewer		

Table of Contents

1 Options Development 1

1.1 Background 1
1.2 Development of the SoN through to Longlist 1
1.3 Application of the Constraints, Design Principles and Criteria to the Options Development 6
1.4 The Options 7

A1 Standard Instrument Departures 1-1

A1.1 Runway 27 SID AGGER 1-1
A1.2 Runway 27 SID WAL 1-5
A1.3 Runway 27 SID TEMP2 1-8
A1.4 Runway 09 SID AGGER 1-10
A1.5 Runway 09 SID CAVEN 1-13
A1.6 Runway 09 SID CORKA 1-18

A2 Transition Procedures 2-1

A2.1 Transition DIOUF 2-1
A2.2 Transition NOMSU 2-4
A2.3 Transition VEGUN 2-7

A3 Instrument Approach Procedures 3-1

A3.1 Instrument Approach Procedure Runway 27 3-1
A3.2 Instrument Approach Procedure Runway 09 3-5

A4 Post Engagement Design Options 4-1

A4.1 Runway 27 SID AGGER Option 1b 4-1
A4.2 Instrument Approach Procedure Runway 27 4-3
A4.3 Instrument Approach Procedure Runway 09 Option 3b 4-5

1 Options Development

1.1 Background

The LJLA Airspace Transition project is currently at Stage 2 – Develop and Assess - of the CAP 1616 Airspace Design process. Step 2A requires the change sponsor to develop a comprehensive list of options that address the Statement of Need and that align with the Design Principles developed in Stage 1.

This document provides a narrative explanation of steps taken in Step2A to develop the options for the new arrival and departure routes at LJLA. The document shows how the options evolved from an initial list of all possible options through to a longlist of options taken forward to Step 2B Options Appraisal. There is one annex to this document which contains enlarged images of each of the options developed, against a backdrop of both an Ordnance Survey roadmap for the benefit of community stakeholders, and an aeronautical (VFR) chart for the aviation stakeholders. This document should be read alongside the LJLA Design Principles Evaluation Issue 3 which has also been uploaded to the airspace portal.

1.2 Development of the SoN through to Longlist

1.2.1 Overview

The procedure design options were developed by CAA Approved Procedure Designers (APD). The APD began by considering the Statement of Need, Constraints and Design Principles as defined in Stage 1 of the CAP1616 process. An explanation of how each of these were applied to the development of the options is contained below.

1.2.2 Extract of Statement of Need

The full Statement of Need (SoN) is available in Stage 1A of the airspace portal and the key elements in terms of design are illustrated by the following extracts. The first illustrates the complexity of the airspace around LJLA with Manchester above and to the east, with restrictions to the west that enable overland access for general aviation. There is also a low-level corridor between LJLA and Manchester Airport used by general aviation users. This complexity in the airspace led the APD to immediately discount any options that would require extension of the extant airspace.

SoN Extract 1: Airspace

[*The Liverpool Control Zone (CTR) currently operates below the Manchester Control Area (CTA) up to 2,500 ft AMSL (Class D airspace). The ATZ dimensions are Surface to 2,000 ft and the Liverpool CTR extends from the Surface to 2,500 ft AMSL. West of a north-south line through Liverpool, the Liverpool CTA extends from 2,500 ft to 3,500 ft AMSL (Class D airspace). To the west and north of Wallasey the Liverpool CTA extends from 1,500 ft to 3,500 ft (Class D airspace) in order to create an overland route for General Aviation traffic around the Wirral peninsular to Wallasey. To the west of Liverpool, coincident with Airways L10 and L975, are 8nm long portions of Class D airspace extending up to 3500 ft AMSL (airway base) and designated as Liverpool CTA. Further airspace is delegated to Liverpool by PC Wallasey Sector, but close cooperation with Manchester Approach is necessary when operating in these areas. A further area of Class A airspace to the south is also delegated to Liverpool up to 4000 ft AMSL*]

An explanation of the airspace complexity was presented to stakeholders during the focus groups in Step 1B to show why LJLA was not proposing any changes to the airspace. The Step 1B presentation included Figures 1 and 2 below. Figure 1 shows the lateral and vertical extents of the airspace belonging to LJLA with each area being labelled e.g. Liverpool CTA2, with a declaration of the lower and upper altitude associate with that area e.g.: 2000ft to 3500ft.

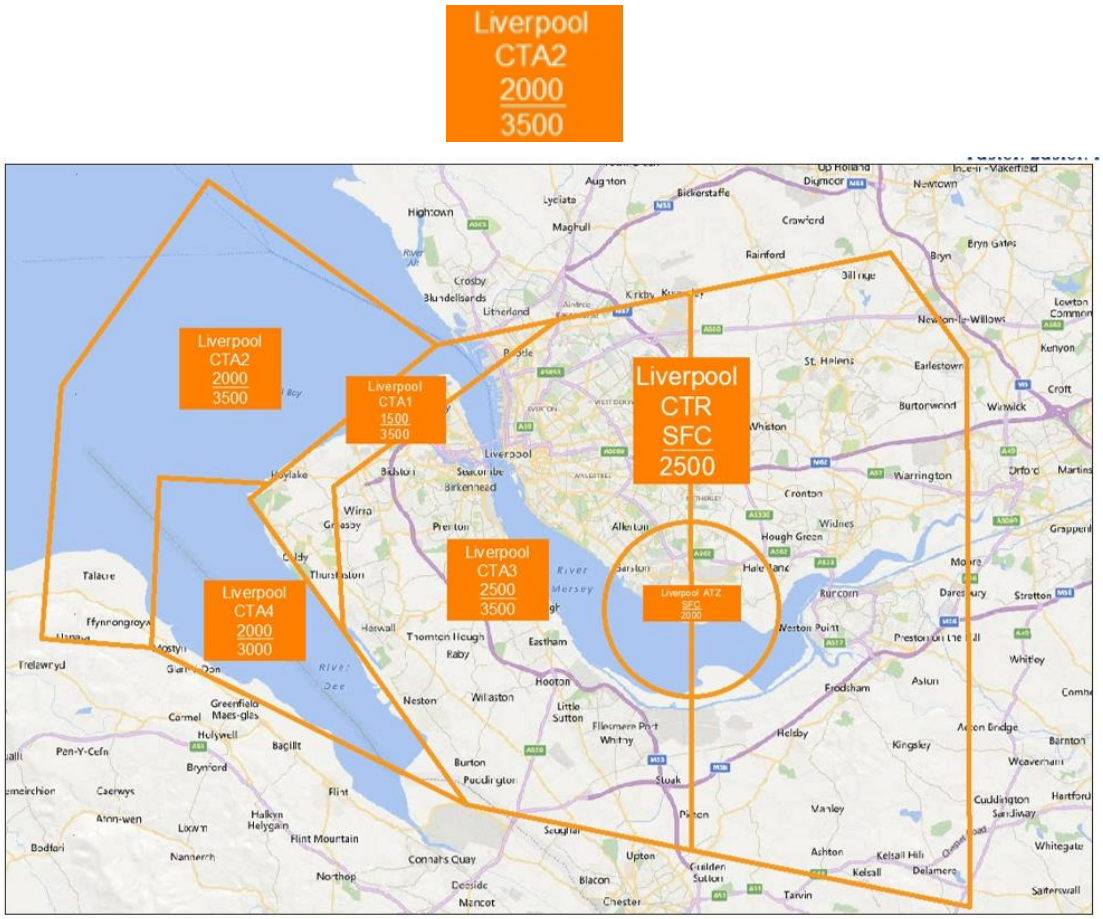
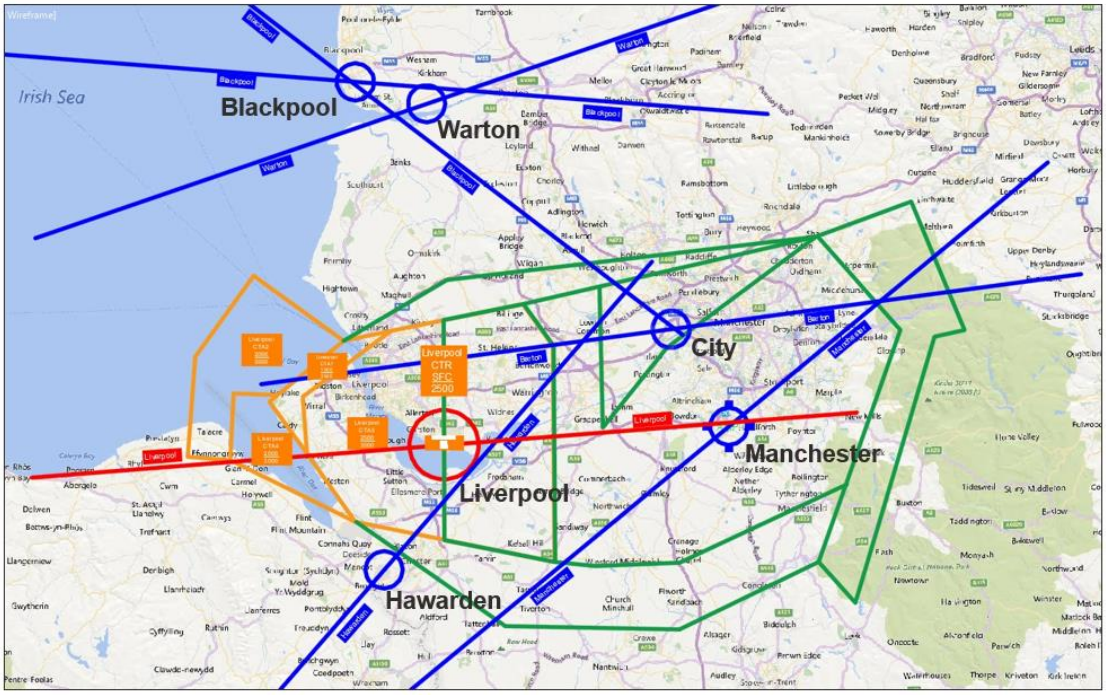


Figure 1 LJLA Airspace areas and altitude

Figure 2 below was presented to the stakeholders to show how Manchester Airspace (green) adjoins and overlaps LJLA airspace, and to illustrate the arrival and departure of traffic at other airports. The red line shows the direction of take-off and landing for LJLA traffic, and the blue lines show the direction of traffic taking off and landing at other local airports i.e. Manchester, City Airport, Hawarden, Blackpool and Warton Aerodrome. Figure 2 was designed to illustrate further the complexity of the airspace. Images (not replicated here) were also presented showing the tracks of all aircraft on a given Summer day arriving and departing from all regional airports, to demonstrate how busy the region is.

Figure 1 and 2 were presented to the stakeholders again in Step 2A as part of the options presentation when LJLA tested the initial options with the stakeholders. LJLA used these maps to describe why they were not considering options that required alteration of the airspace.



SoN Extract 2: Instrument Flight Procedures

The second extract from the Statement of Need relates to the implementation of Performance Based Navigation (PBN) instrument flight procedures and implies the requirement for more efficient interfaces with the enroute structure. The enroute structure means the airways and routes that aircraft follow once they have left, or before they arrive into LJLA airspace.

[… *to meet the airline demand for PBN Infrastructure and improved resilience and redundancy of its airport operations. The improved efficiencies will also help to protect capacity for any future growth. Introduction of PBN Procedures will drive new procedure designs that minimise delays and allow for more efficient interfaces with adjacent air traffic organisations. An aspiration of LJLA is to introduce procedures that also offer environmental benefits, wherever possible within the constraints of PANS OPS compliant final designs*.]

1.2.3 Constraints

Five constraints were identified during Stage 1 ASSESS:

1. C1: Instrument Flight Procedures must be PANS-OPS 8168 compliant;
2. C2: Instrument Flight Procedures must be safe.
3. C3: Integration with Future Airspace Strategy (North) - FASI (N)[1]
    a. Manchester TMA
    b. Scottish Terminal Control Area
    c. Belfast Terminal Control Area
    d. Irish Sea Sector Ops
    e. (see also C4 below)

[1] FASI(N) is a combination of airspace redesign modules that comply with the UK's Future Airspace Strategy through the provision of Performance Based Navigation routes, Standard Instrument Departures and Standard Arrival Routes which facilitate continuous climb and continuous descent operations, user preferred routes, Flexible Use of Airspace and simplified boundaries between controlled and uncontrolled airspace. The redesign and modification will include the Manchester Terminal Control Area, Scottish Terminal Control Area, Belfast Terminal Control Area and Irish Sea sector operations.

4. C4: Fixed airway entry and exit points, and runway position
5. C5: Integration with other local airspace users
    - Prestwick Centre –provides enroute traffic with air traffic control services. NATS[2] and military air traffic controllers[3] manage traffic from this centre.
    - Manchester Airport – integrate with Manchester departure and arrivals.
    - City Airport
    - Hawarden Aerodrome
    - RAF Shawbury
    - BAES Warton
    - Blackpool Airport
    - Tilstock Parachute Centre
    - General Aviation Community

1.2.4 Application of the Constraints to the Design Process

The requirement for all design options to be PANS OPS 8168 compliant **(C1)** means that the parameters of the Instrument Flight Procedures (IFP), e.g. shape, accuracy, turn areas and obstacle clearances are predetermined (to a degree) in ICAO document *PANS-OPS 8168 Aircraft Operations – Volume 2 Construction of Visual and Instrument Flight Procedures*. This is the international standard for all IFPs. IFPs must be designed by an CAA Approved Procedure Designer (APD).

Constraints **C3** (Integration with FASI(N)) and **C4** (Fixed entry and exit points, and runway position) are the necessary starting points for developing the design options to ensure full connection between LJLA and the enroute airways:

- The runway position is fixed and designated 09/27: this means that the runway orientation is on a bearing of 090° (the 09 direction) and the opposite direction 270° (the 27 direction). The runway direction in use on a given day is selected based on the wind direction. Aircraft take off and land in the same direction, i.e. 'into the wind'. Runway direction may change during the day if the wind changes.
- Traffic departing LJLA begins on the runway and after taking off straight ahead, must fly a series of turns and straight sections known as a Standard Instrument Departure (SID). The SID finishes at the airway entry point.
- Traffic arriving at LJLA leave the airways at fixed points and must fly a 'Transition' route to join an 'Approach' procedure that ends in a straight section lined up to the runway.
- Transitions are required to follow the most expeditious route.
- The entry and exit points for the airways have fixed locations and fixed altitude (height) for example, aircraft departing LJLA to enter the airways to the north, must fly to a point called AGGER (new routes) which has an altitude of 11,000ft. Aircraft must reach this altitude to enter the airway.

When the start and end points of the procedures (e.g. the fixed enroute waypoints and the runway position) are already defined, there are a limited number of routes that can be plotted between them that remain PANS-OPS compliant **(C1)** and flyable,

[2] NATS – National Air Traffic Services. NATS is the enroute air traffic services provider that manages air traffic in the enroute airways structure and in other airspace volumes.
[3] Military air traffic controllers are typically co-located with enroute air traffic controllers in order to coordinate military/civil enroute traffic.

especially in such constrained airspace **(C5)**, expansion of which was immediately rejected due to Manchester and other airspace. This limitation was explained to the stakeholders at the engagement events during step 2A.

The IFPs must be safe (**C2)** and therefore the designers had to take into account the minimum requirements for separation from terrain and obstacles, and from other procedures/volumes of airspace which further limited the number of feasible options. The primary means by which it is intended to provide safety assurance evidence to support the options is a Safety Case developed in accordance with CAP760[4]. The Safety Case is under development and the first stage (Hazard Identification) took place during Step 2B where one option was discarded on safety grounds. More information on the Safety Assessment is contained in Section 5**Error! Reference source not found.** of the Initial Options Appraisal Issue 4 in Step 2B on the airspace portal.

C5, integration with other local airspace users was considered during the design process and through the engagement of those users during the CAP1616 process. For example, Blackpool Airport confirmed that the proposed routes were all clear of their operations, whilst Hawarden Airport discussed their operations during an engagement visit from LJLA staff. The Police provided neutral but helpful comments regarding their ability to fly IFPs.

1.2.5 Possible Options that Don't Meet the Constraints

The initial options list included one option that didn't meet the PANS OPS constraint **(C1)** – this option was included for discussion with the stakeholders because it most closely replicated the current departure routes. The non-compliant initial turn was attributable to the runway declared distances and the unique topography to the west of the runway. The option is technically flyable and safety assurance was deemed possible; advice on the inclusion of this option was sought from the CAA IFP design team. More information on this option and why it was discarded at a later stage can be found on page 12 of the Design Principles Evaluation document (Issue 3) on the CAA portal at Step 2A.

1.2.6 High-Level Design Criteria

In accordance with the requirements in paragraph E18 of CAP1616, a set of high-level criteria was developed from the Design Principles to support the design process; the application of these criteria to the initial list (tested with the stakeholders) generated the longlist of designs to take forward to Design Principle Evaluation. The best practice guidance contained in the government Green Book[5] was used to develop six high-level objectives or criteria. These criteria are listed below along with the quantitative 'measures' used to gauge each option against the objective.

- Ob 1: The option shall be acceptably safe
  - Obstacle clearance, separation standards, PANS-OPS 8168.
- Ob2: Minimise emissions
  - Facilitates optimum aircraft power to minimise greenhouse gases and air quality effects.
- Ob3: Minimise noise
  - avoid overflying sensitive areas below 7000ft

[4] CAP760: Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases: For Aerodrome Operators and Air Traffic Service Providers

[5] The Green Book: appraisal and evaluation in central government: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

- Ob4: Maintain operational performance and capability
    - Fly-ability
    - Containment within CAS
    - Availability of alternative to avoid other aviation operators
- Ob5: Improve operational efficiency
    - Reduction in track miles
    - Reduction in probability of vectoring by ATC
    - Enables continuous climb/ continuous descent
    - Enables Predictability of Tracks
- Ob6: Minimise number of people overflown
    - Numbers overflown

1.3 Application of the Constraints, DPs and Criteria to the Options Development

LJLA first applied the Constraints and the Design Principles to the design process to produce the initial list of possible options. For example, plotting the most expeditious routes to reduce track miles and emissions, and incorporating PANS OPS compliant turns and waypoints that avoided overflying sensitive areas such as schools, hospitals and residential areas in Runcorn and The Wirral. Further efforts were made to route aircraft above the motorways or industrial areas where higher ambient noise already exists or to route aircraft over the Mersey to avoid overflight of residential areas. A new hold was designed to ensure aircraft waiting for clearance for final approach would be kept over the sea instead of flying the race-track pattern above the airport and the villages in the vicinity. Standard T-Bar shaped Approaches were considered for approaches to runway 27 with Y-bar options not possible due to airspace constraints to the east. Straight in options were developed for runway 09 approach to avoid unnecessarily increasing track miles and to keep the procedure over the sea/River Mersey.

The initial list of possible Design Options was shared with the stakeholders and representative bodies that contributed to the development of the Design Principles in Stage 1. The initial list included one option, as described in paragraph 1.2.5 above, that didn't meet the PANS OPS constraint **(C1)**.

The airport invited the stakeholders to a face-to-face event where they could view the options on a large map. The airport produced acetate overlays of all the options which facilitated interactive discussion on the options – stakeholders were offered the option to draw on the acetate layers to make suggestions about alternative routes, tighter turns, or to mark sensitive areas that may have been missed. The stakeholders had the opportunity to ask questions such as why LJLA wasn't considering expanding the airspace, and why more direct or even straight-line routes weren't possible between the runway and the airway entry points. Stakeholders were invited to state their preferences for the various options and to give reasons e.g. fewer people overflown, fewer track miles or less conflict with neighbouring airport operations. They also had the opportunity to suggest options that LJLA had not considered: some of these were radical and technically unflyable (such as a straight line from the runway to AGGER which LJLA explained would fail to meet the required altitude at AGGER), but the stakeholders proposed some reasonable and considered options that appeared to meet the constraints.

Following the stakeholder engagement and consideration of the new proposed options against the constraints, LJLA added three additional options to the list – one

SID was re- routed up the Mersey to reduce the number of people overflown, and two further options related to addressing the position of the Missed Approach Procedure and hold.

The initial list of possible options and the three stakeholder proposed options were all assessed to meet the high-level criteria developed from the Design Principles (see paragraph 1.2.6) and were therefore combined to form the **final longlist of options carried forward** to Design Principle Evaluation (DPE).

The DPE demonstrated how the options responded to the Design Principles. Without the approval of the CAA to carry forward a non-PANS OPS compliant design, LJLA chose to reject SID 27 AGGER Option 1 at the DPE stage on the grounds that it did not meet the constraints.

The publication of the DPE along with this Options Development document onto the CAA Airspace portal completed Step 2A.

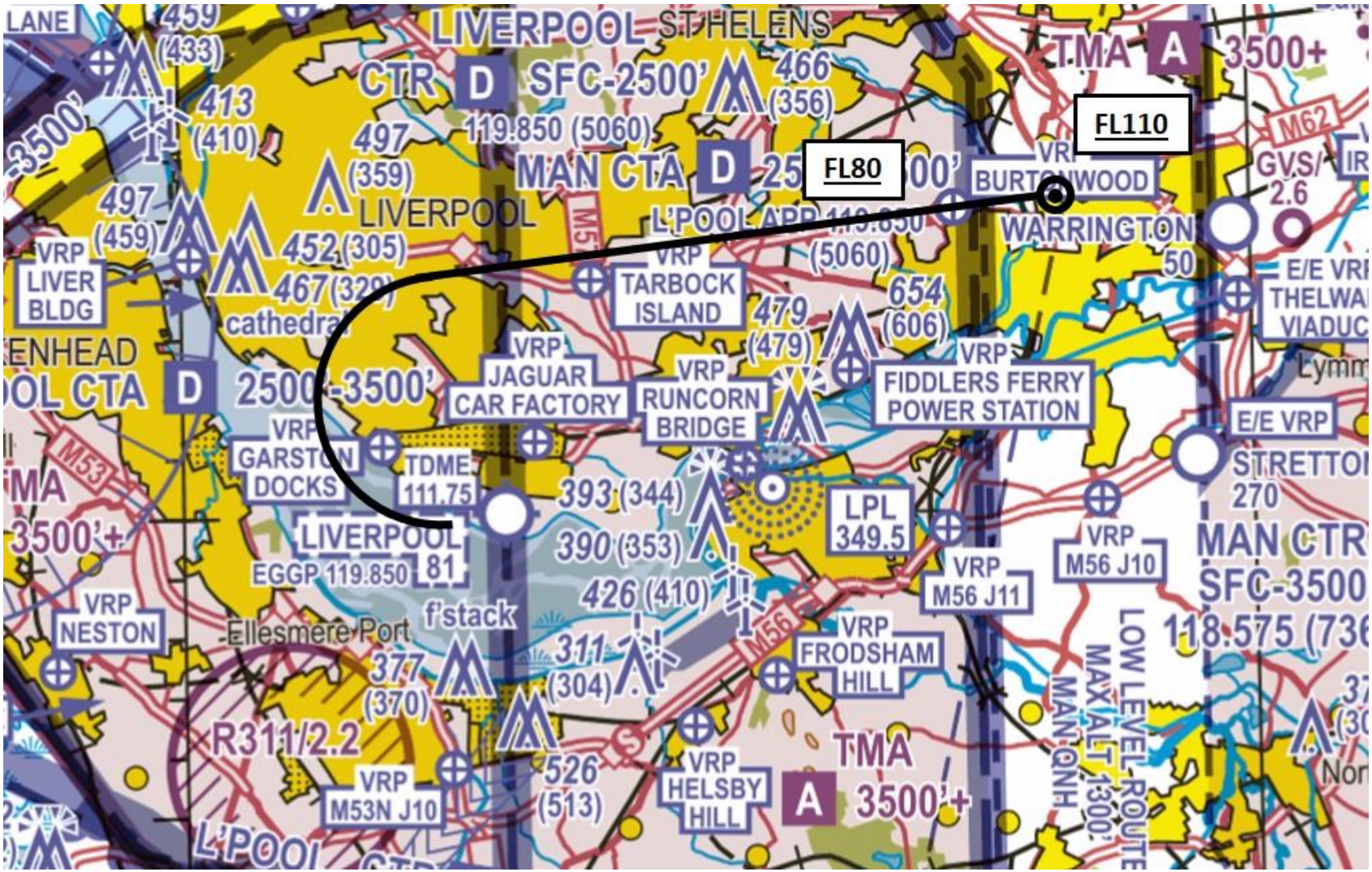
1.4 The Options

Annex A1 includes the images of all of the options that were developed during Step 2A; this includes all options on the initial list that was tested with the stakeholders, and the additional three options proposed by the stakeholders during the engagement events. Each of the flight procedures is marked on an OS roadmap for the benefit of the communities (all options presented on the same map) and non-aviation stakeholders, and separately on the Visual Flight Rules aeronautical chart for the benefit of the aviation stakeholders.

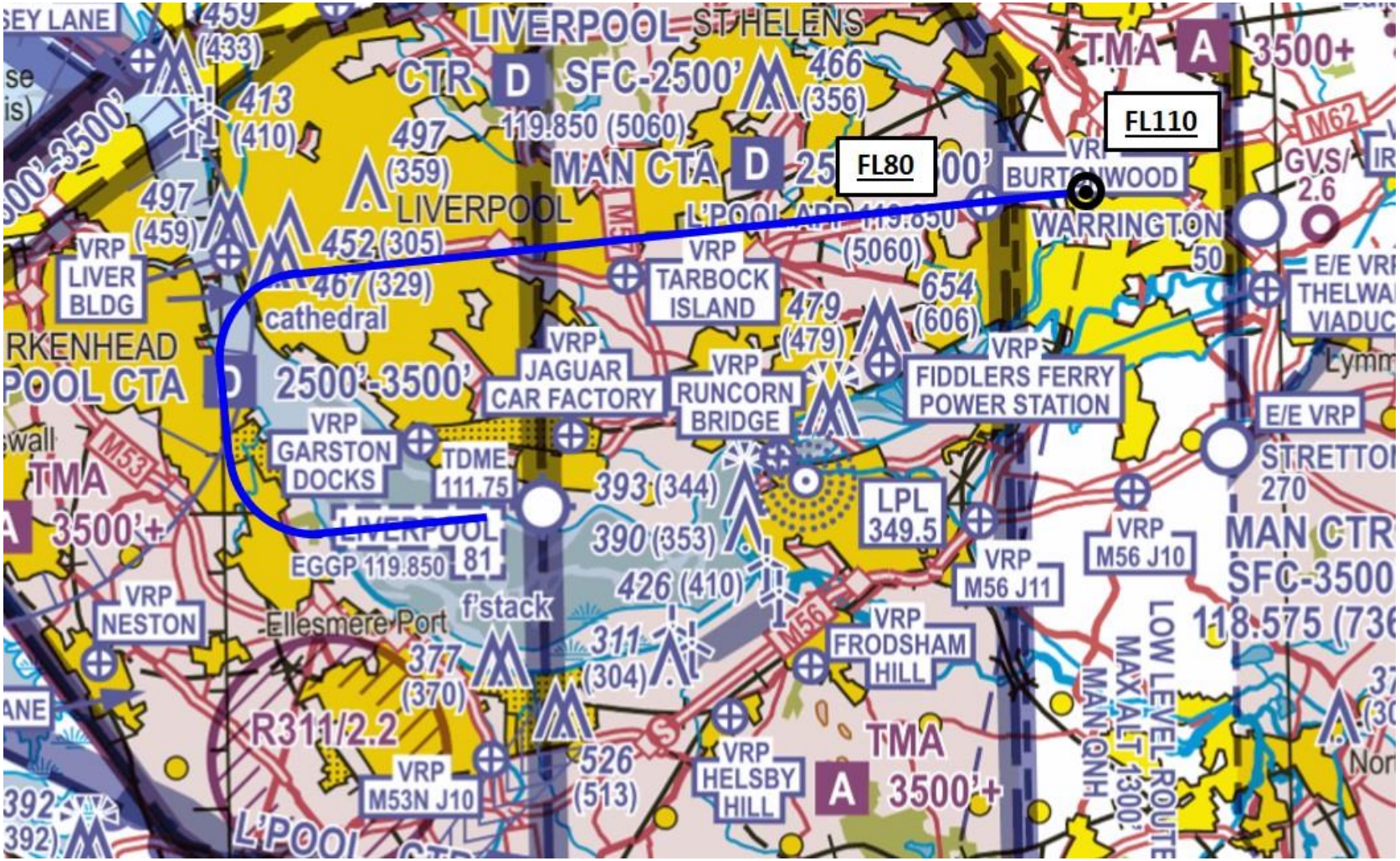
A1 Standard Instrument Departures

A1.1 Runway 27 SID AGGER

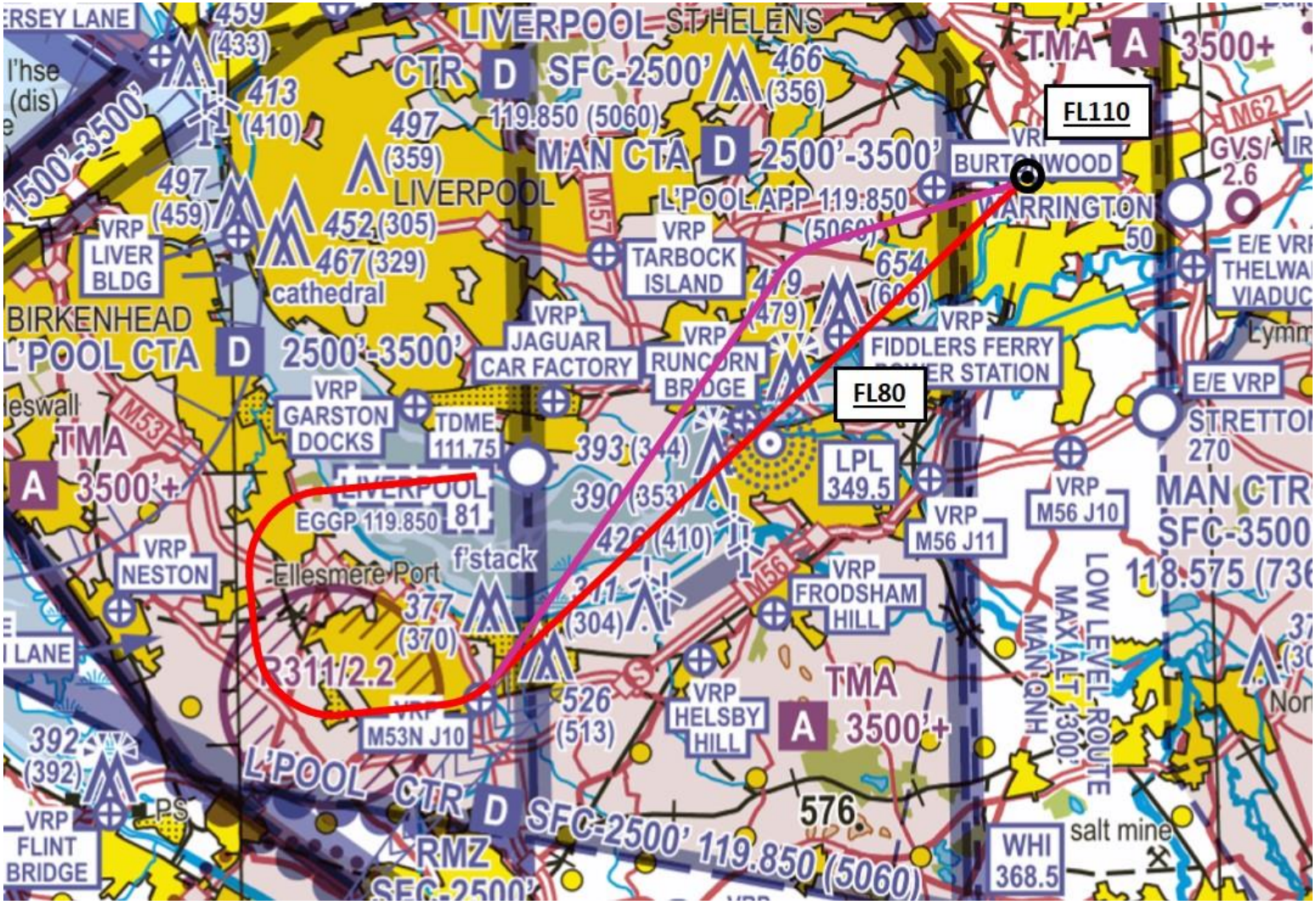
A1.1.1 Runway 27 SID AGGER Option 1



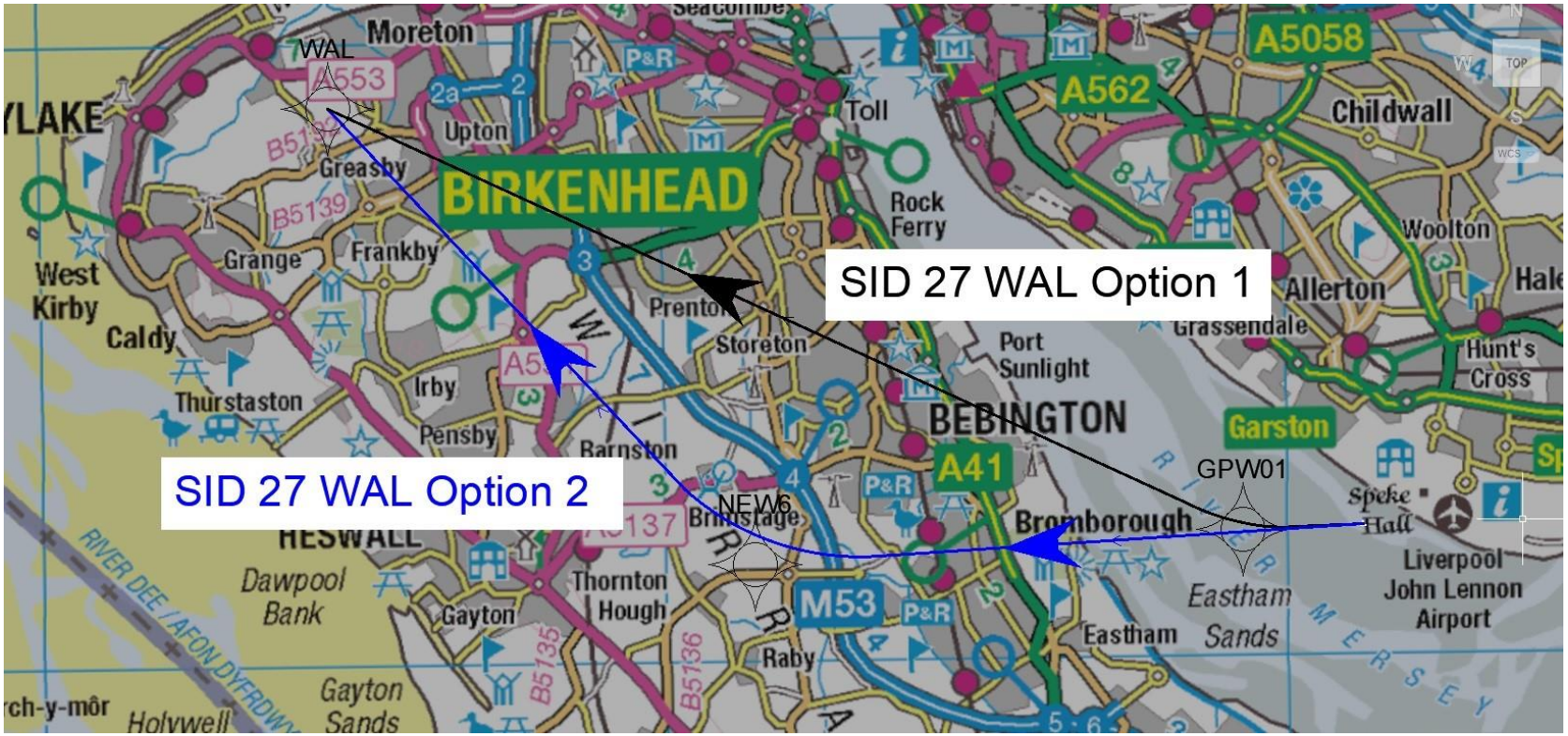
A1.1.2 Runway 27 SID AGGER Option 2



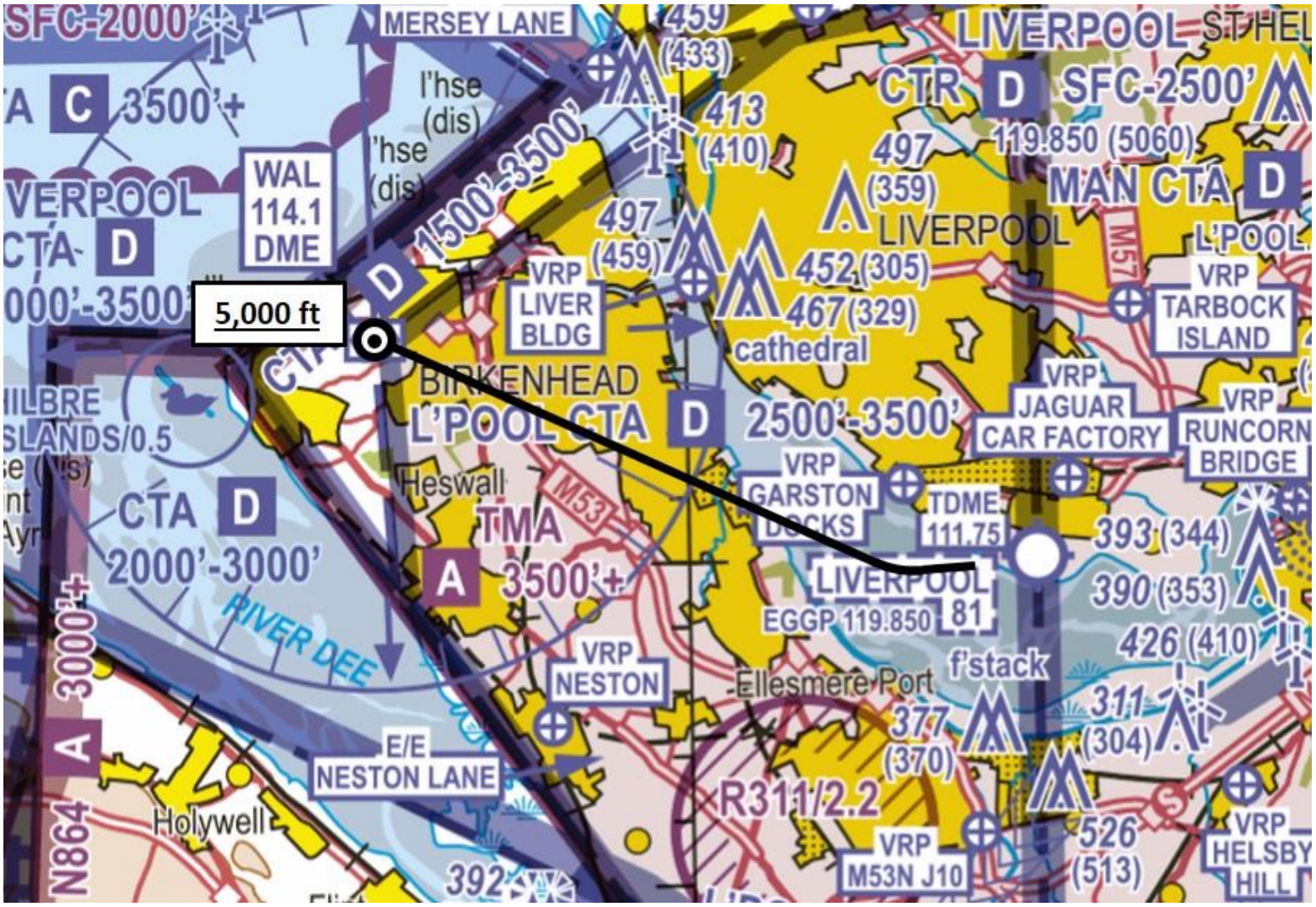
A1.1.3 Runway 27 SID AGGER Option 3



A1.2 Runway 27 SID WAL

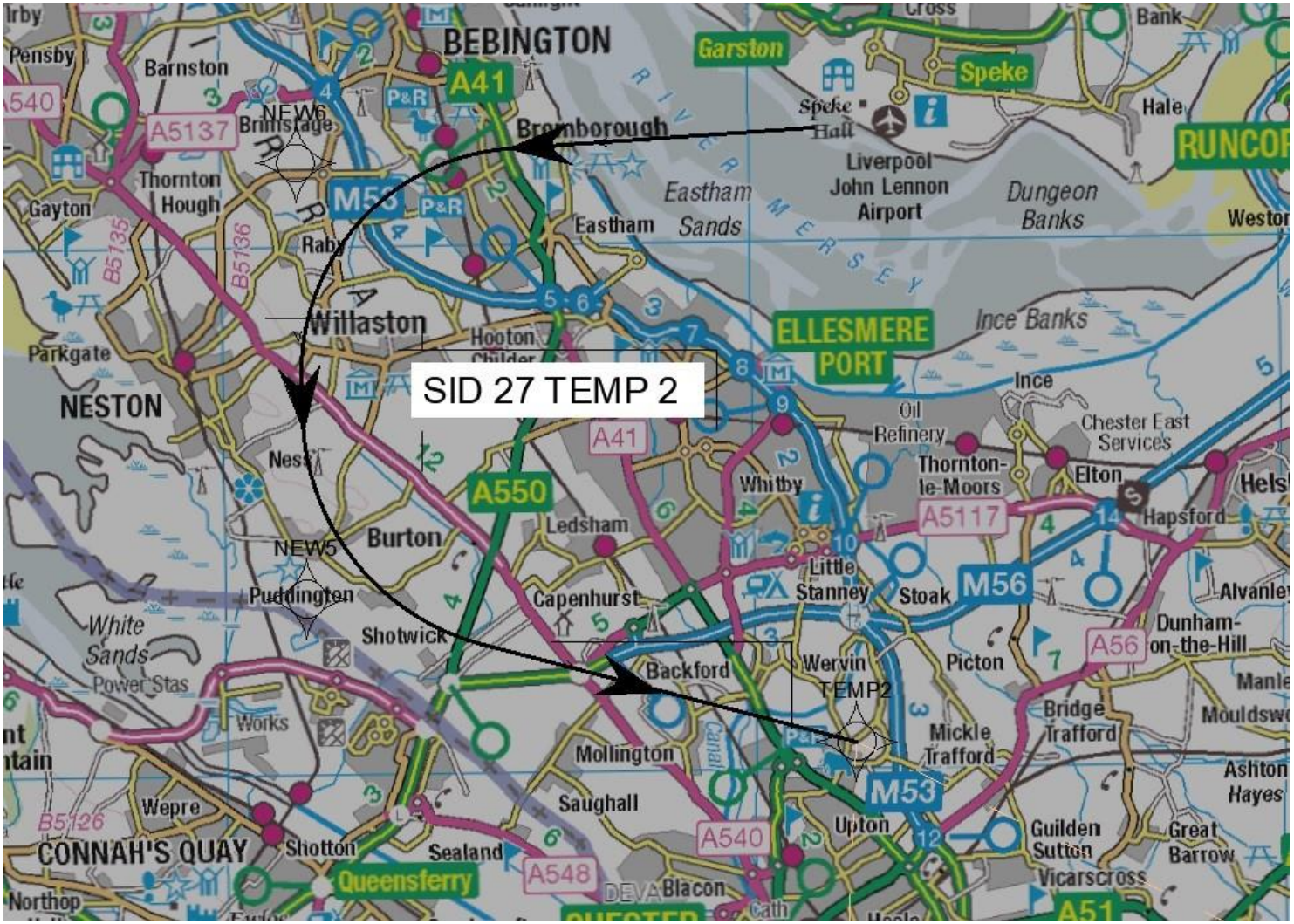


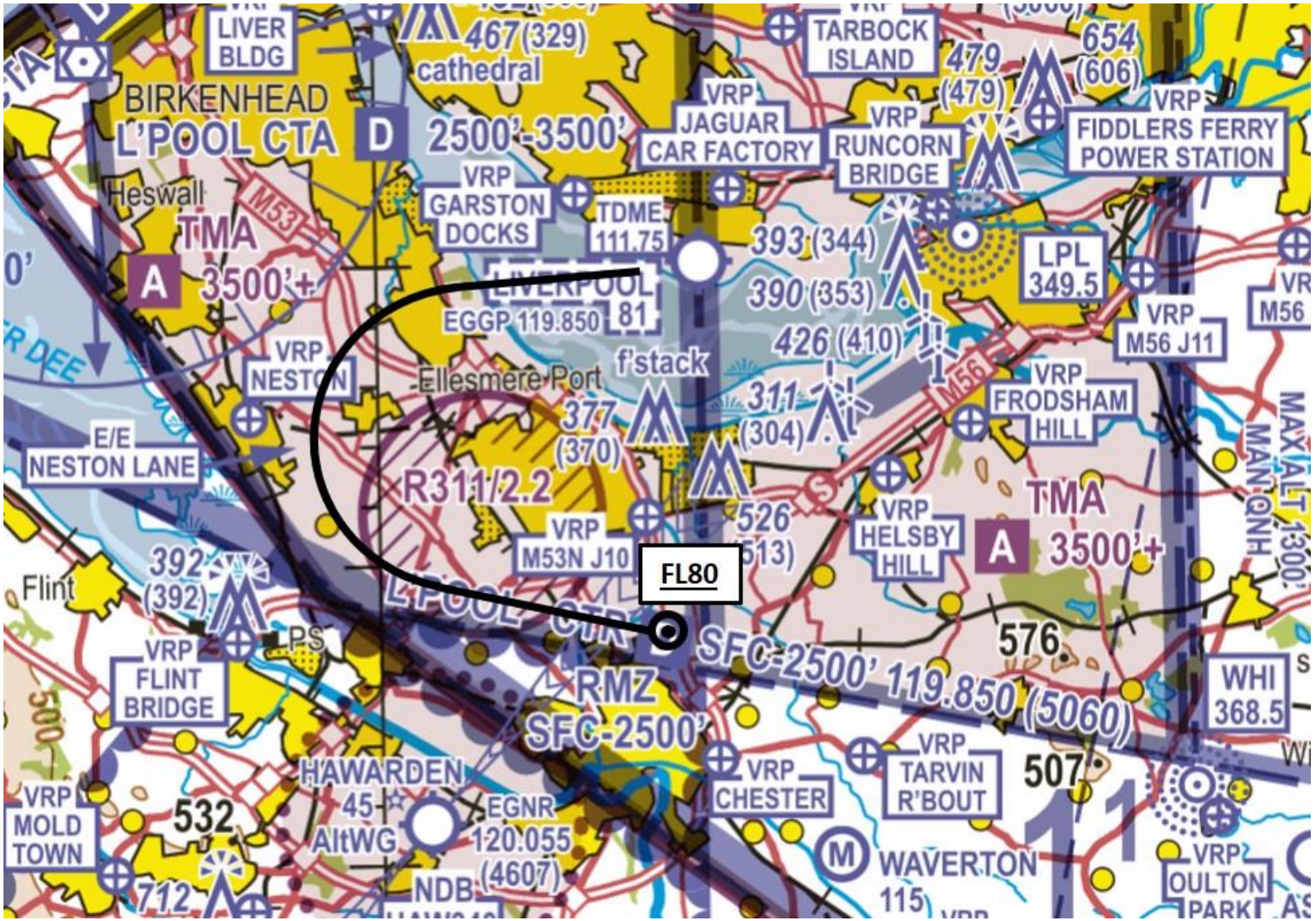
A1.2.1 Runway 27 SID WAL Option 1



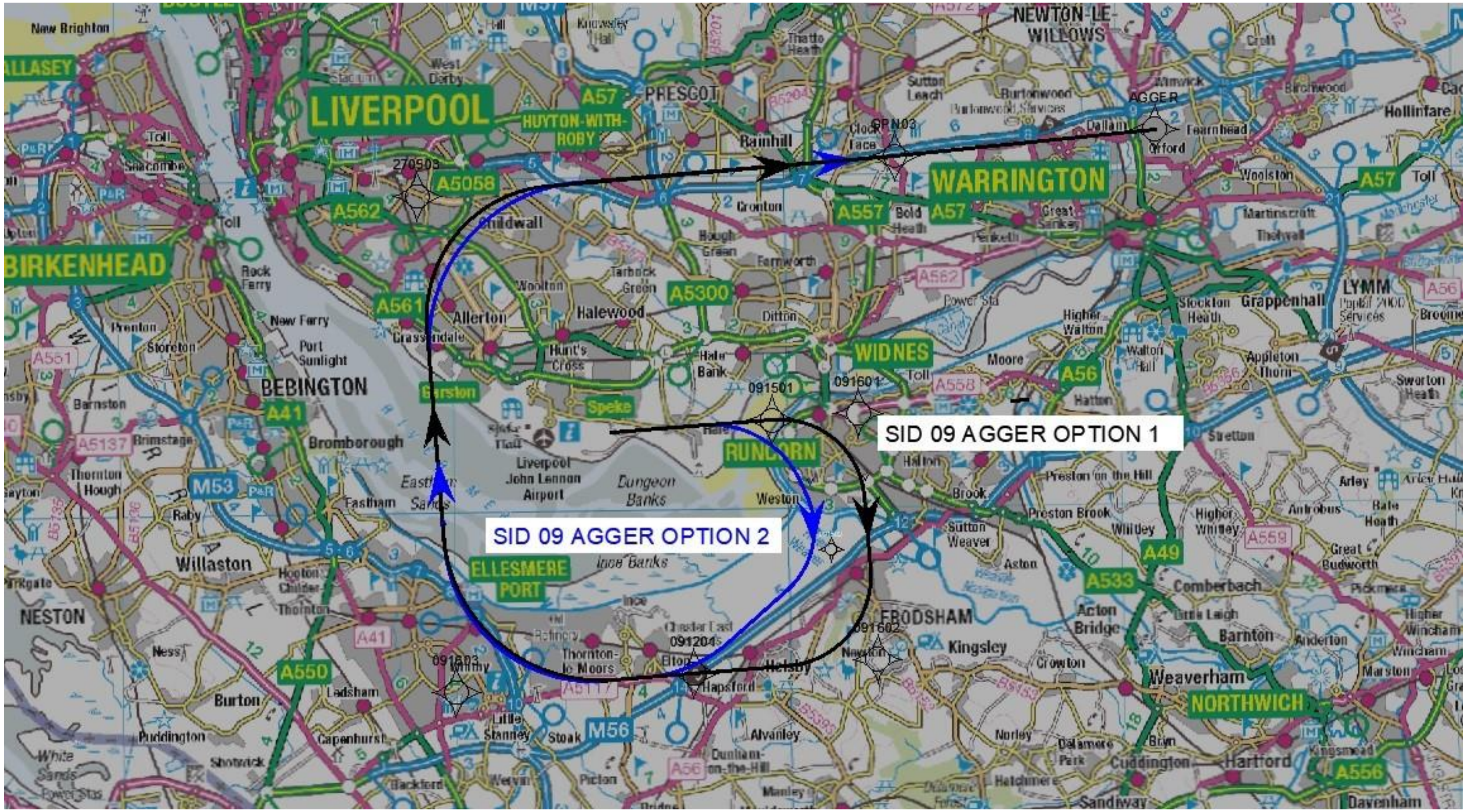
A1.2.2 Runway 27 SID WAL Option 2

A1.3 Runway 27 SID TEMP2

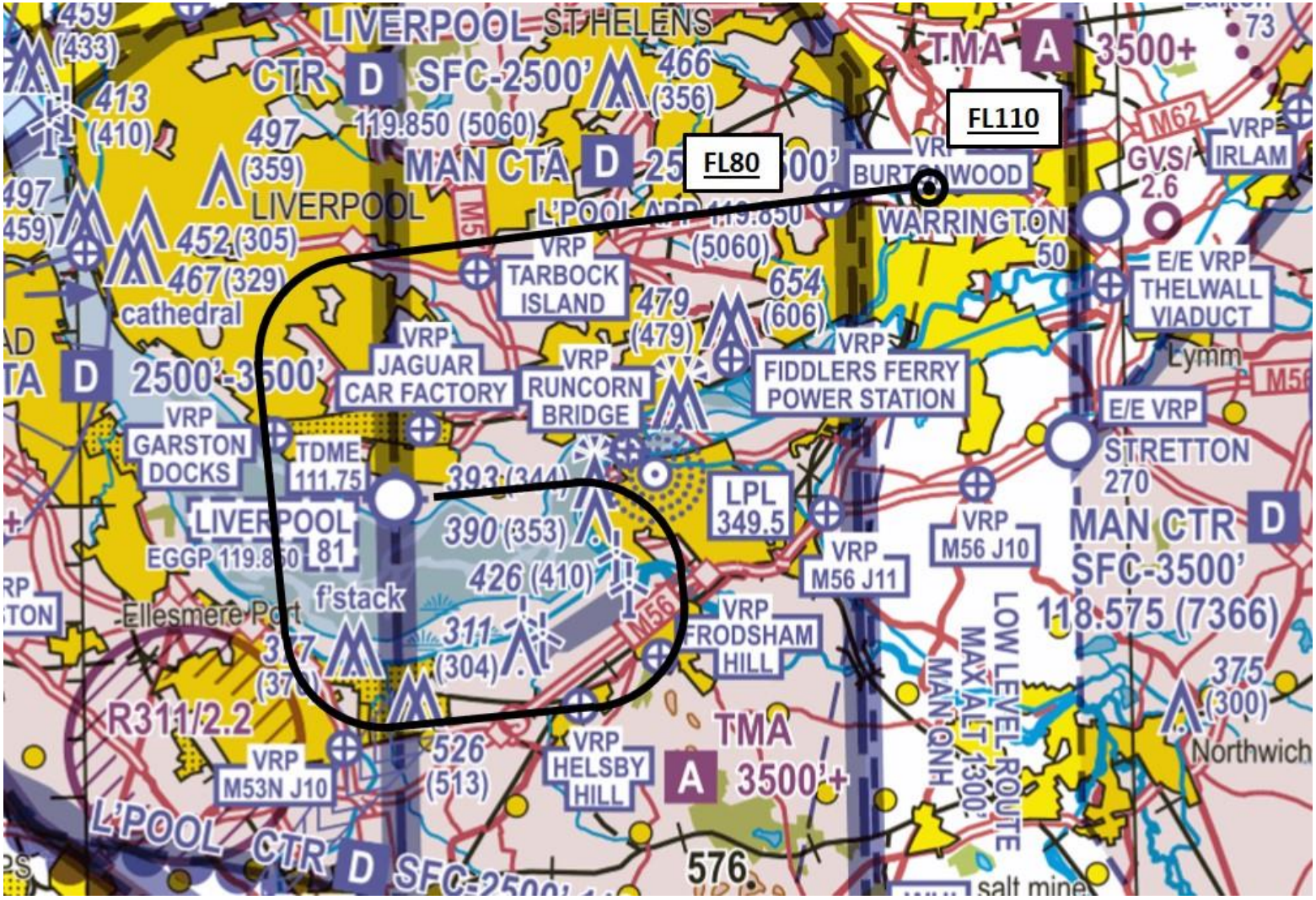




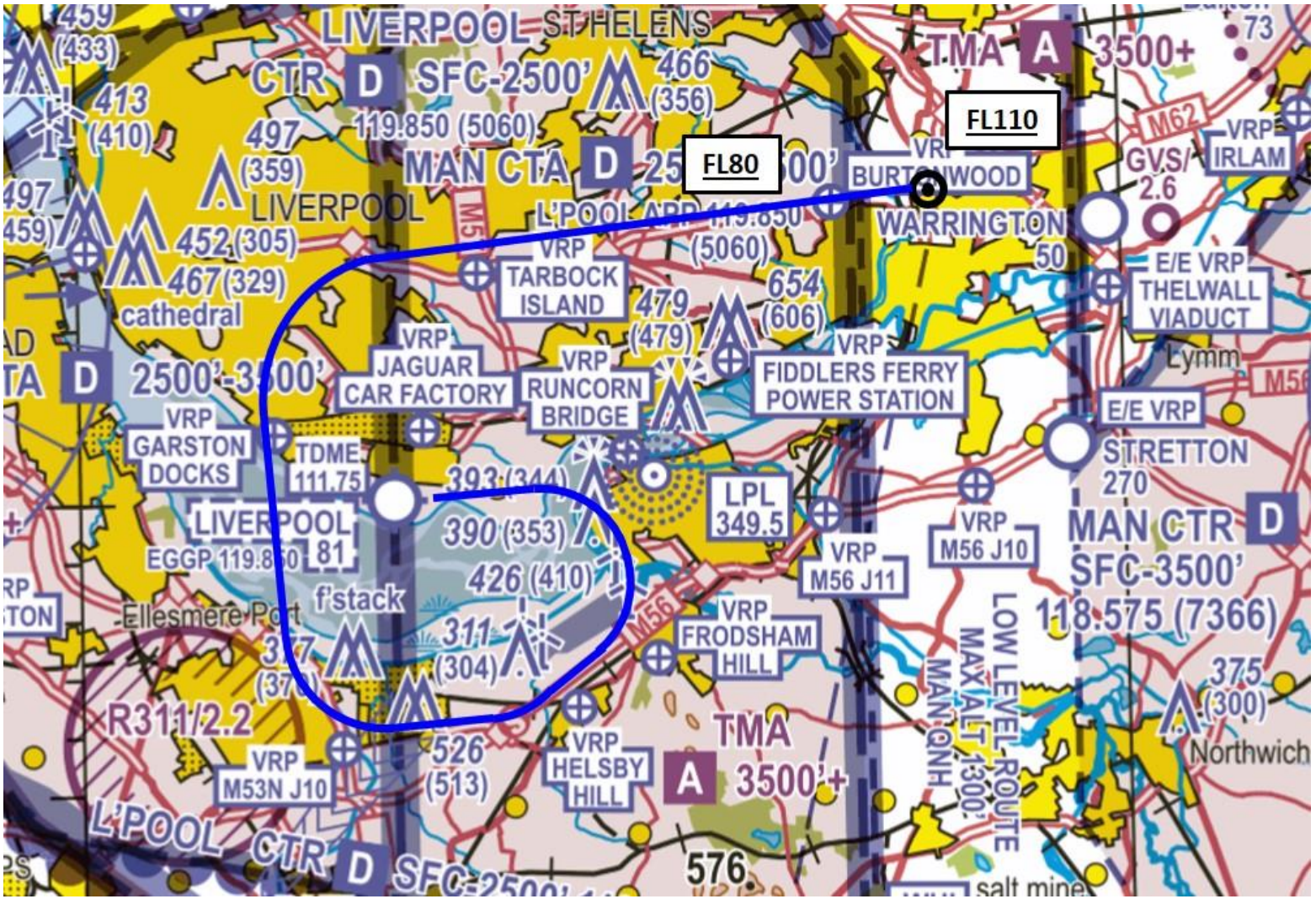
A1.4 Runway 09 SID AGGER



A1.4.1 Runway 09 SID AGGER Option 1



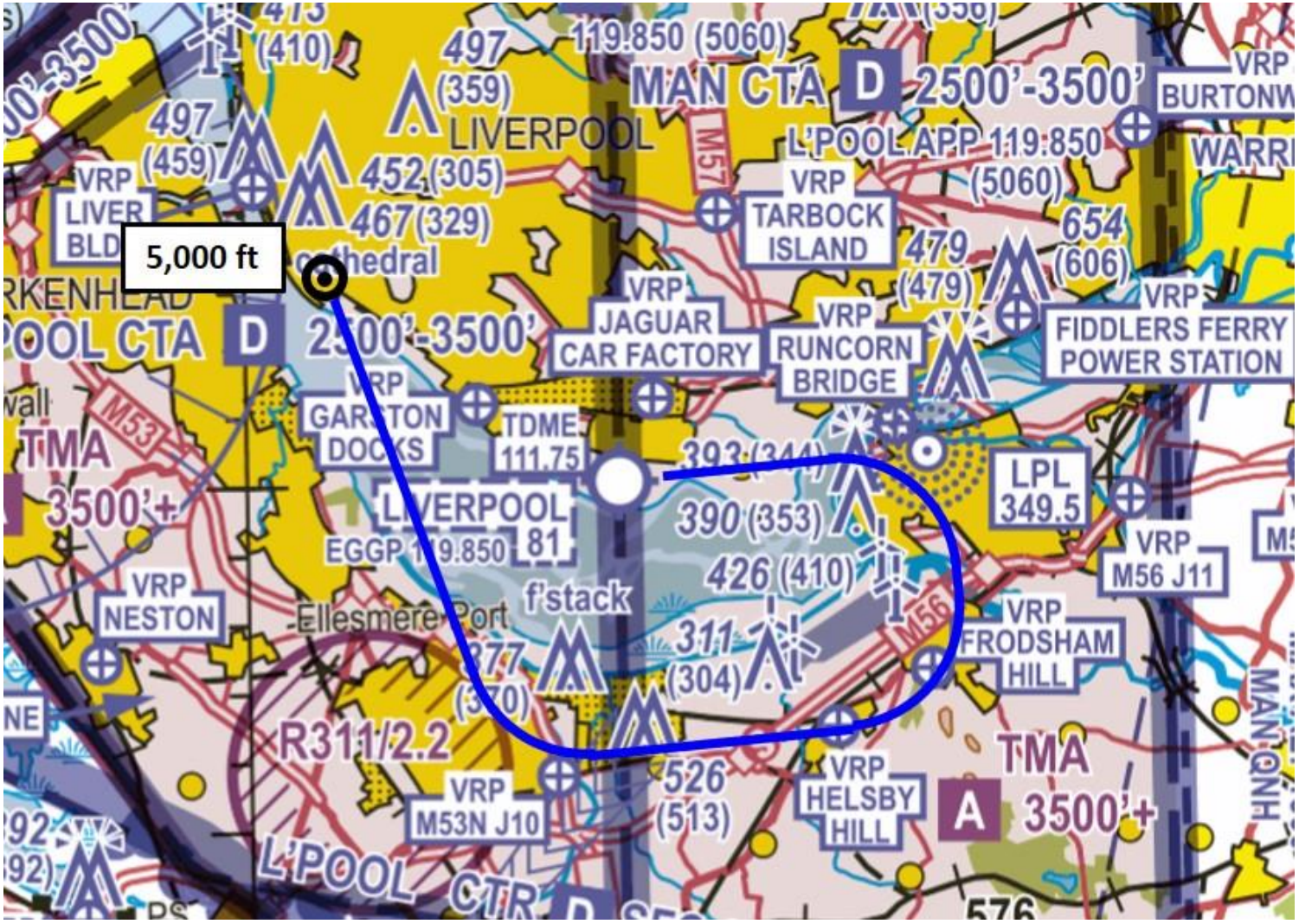
A1.4.2 Runway 09 SID AGGER Option 2



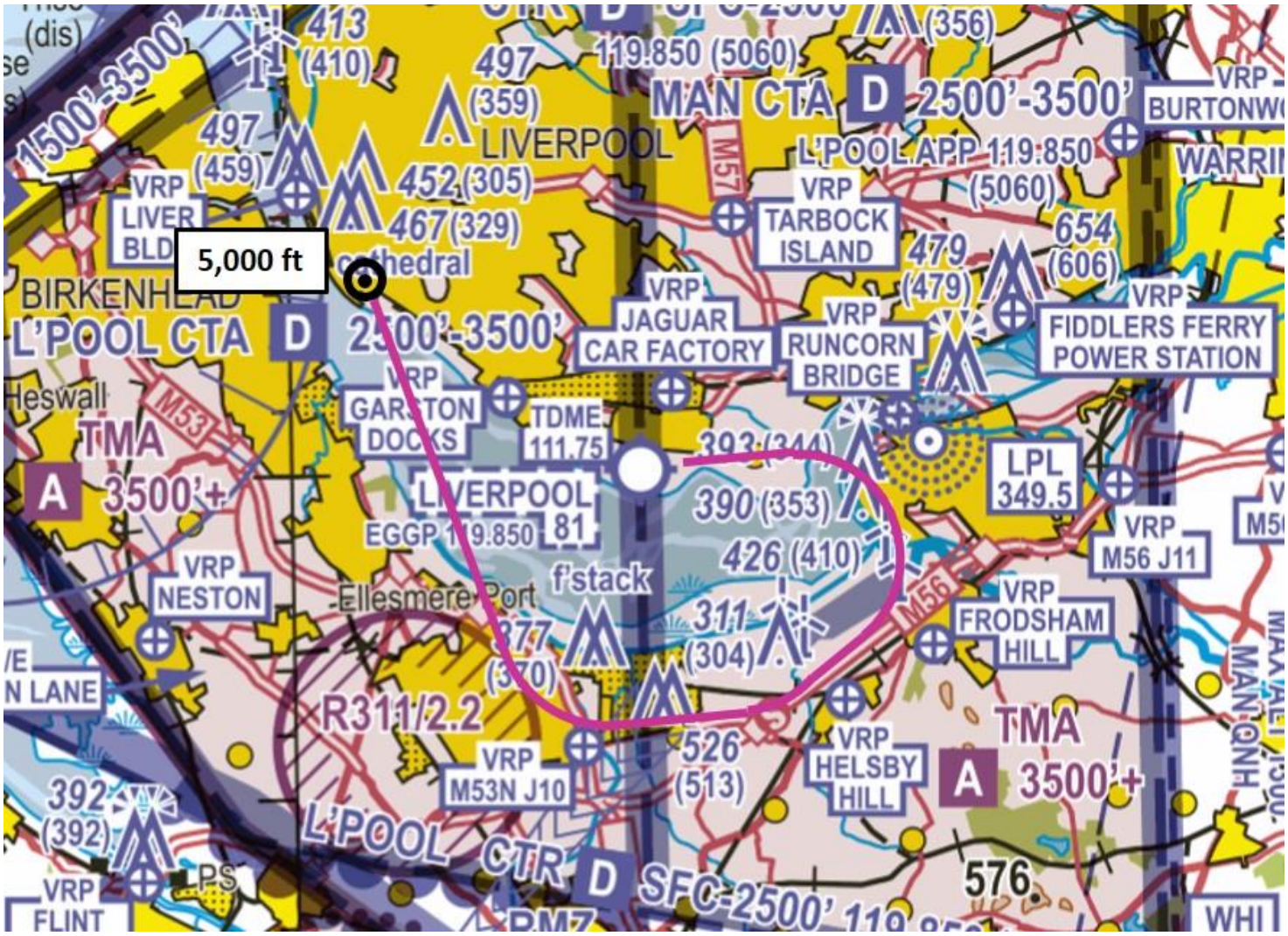
A1.5 Runway 09 SID CAVEN

A1.5.1 Runway 09 SID CAVEN Option 1

A1.5.2 Runway 09 SID CAVEN Option 2

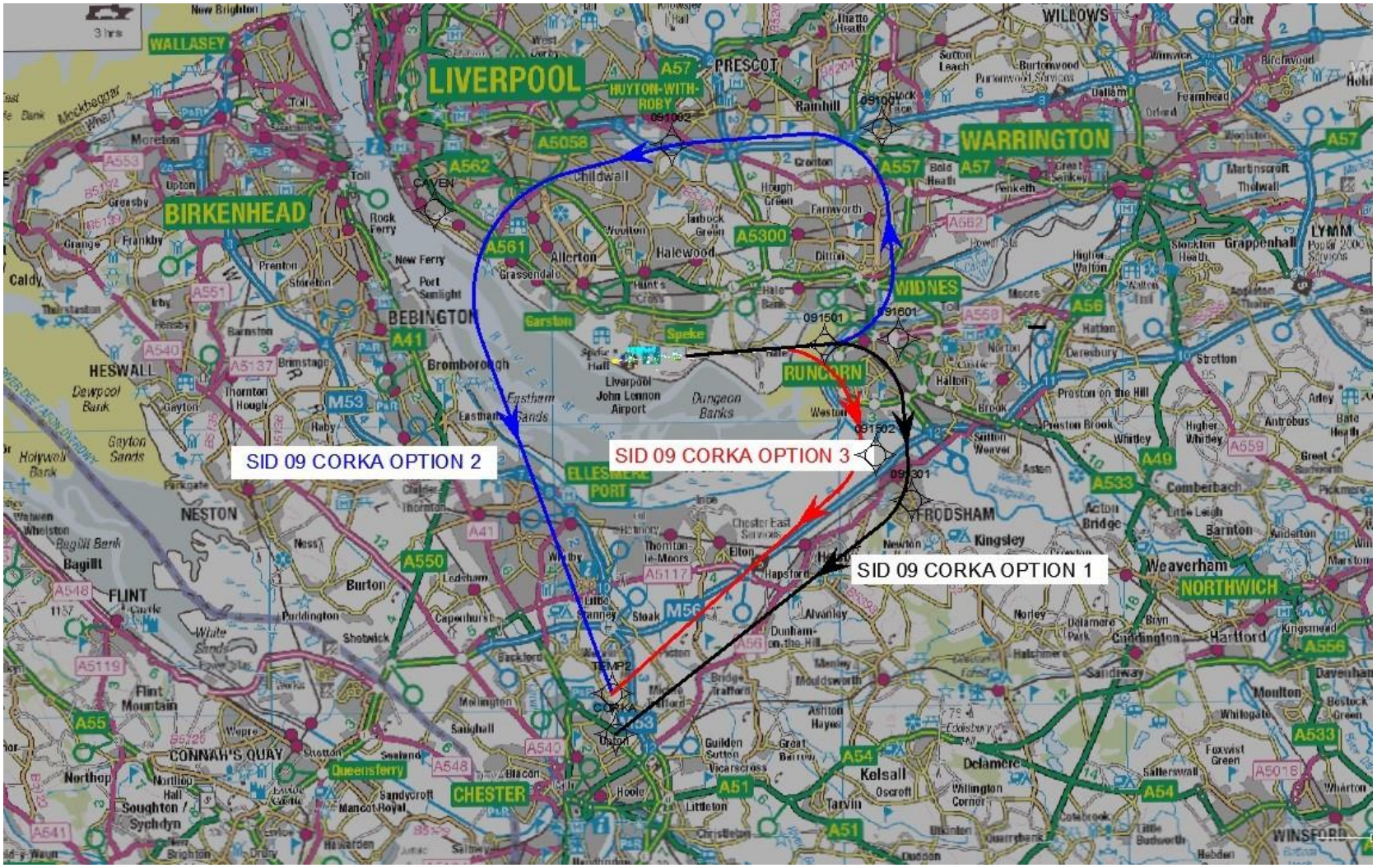


A1.5.3 Runway 09 SID CAVEN Option 3

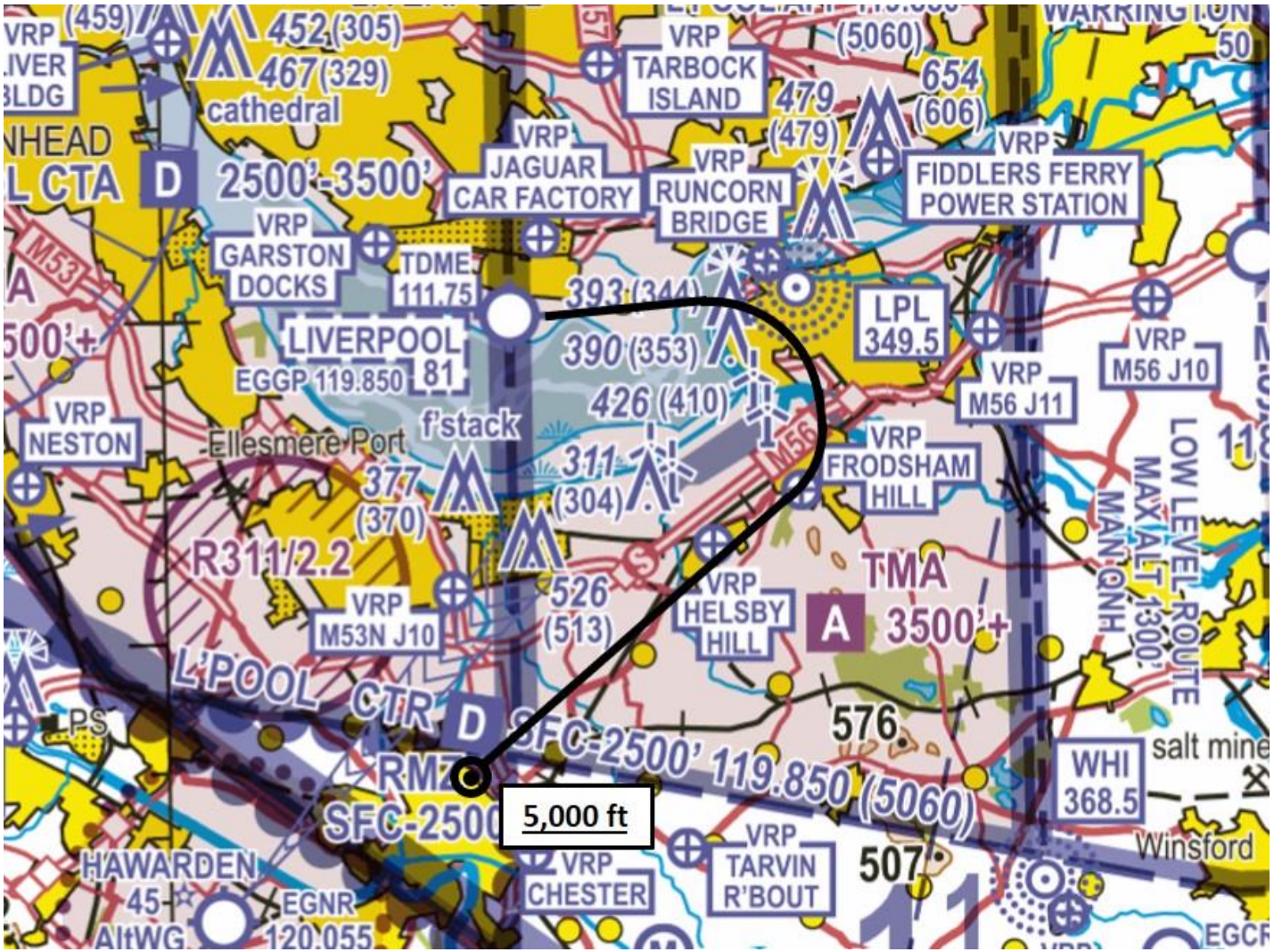


A1.5.4 Runway 09 SID CAVEN Option 4

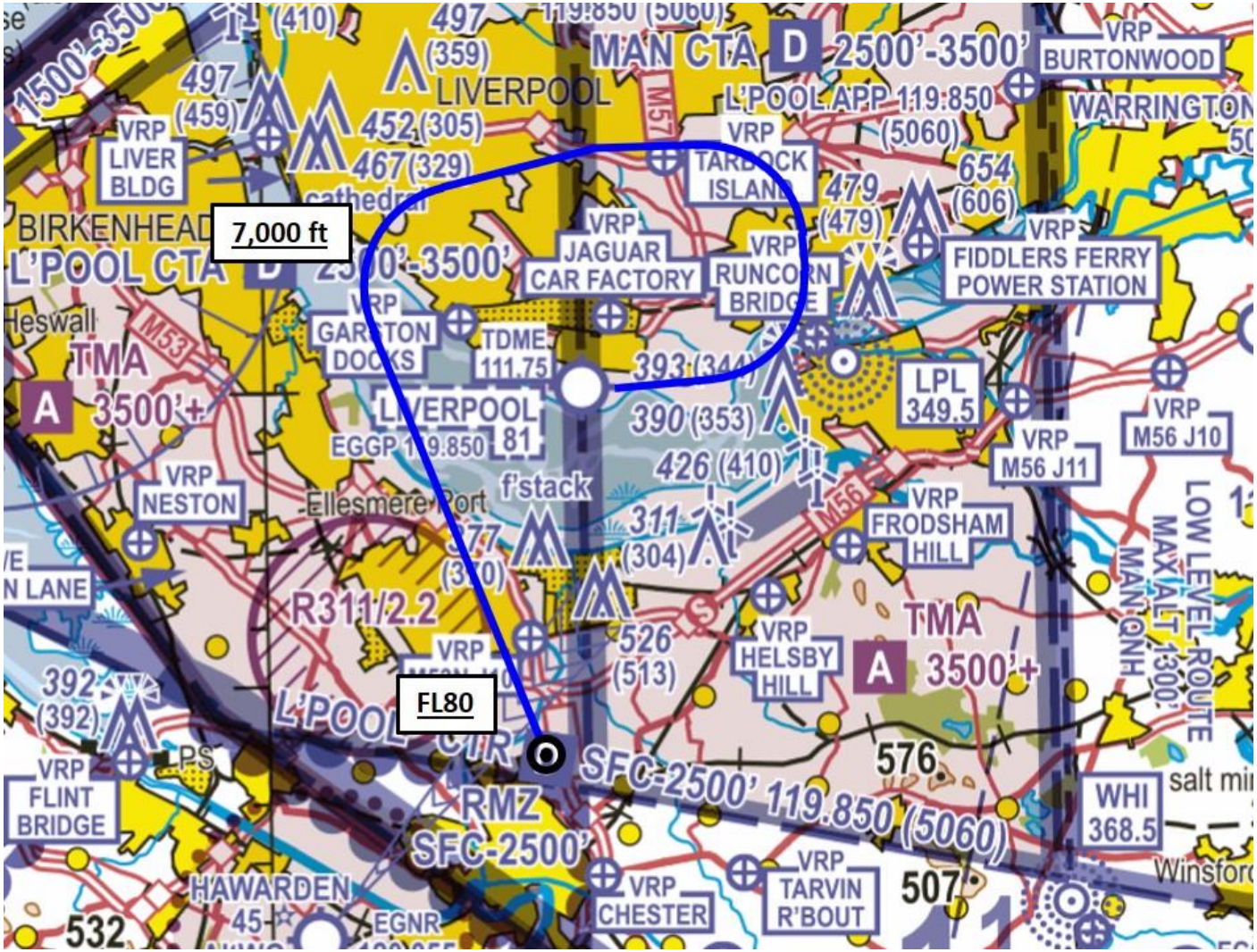
A1.6 Runway 09 SID CORKA



A1.6.1 Runway 09 SID CORKA Option 1



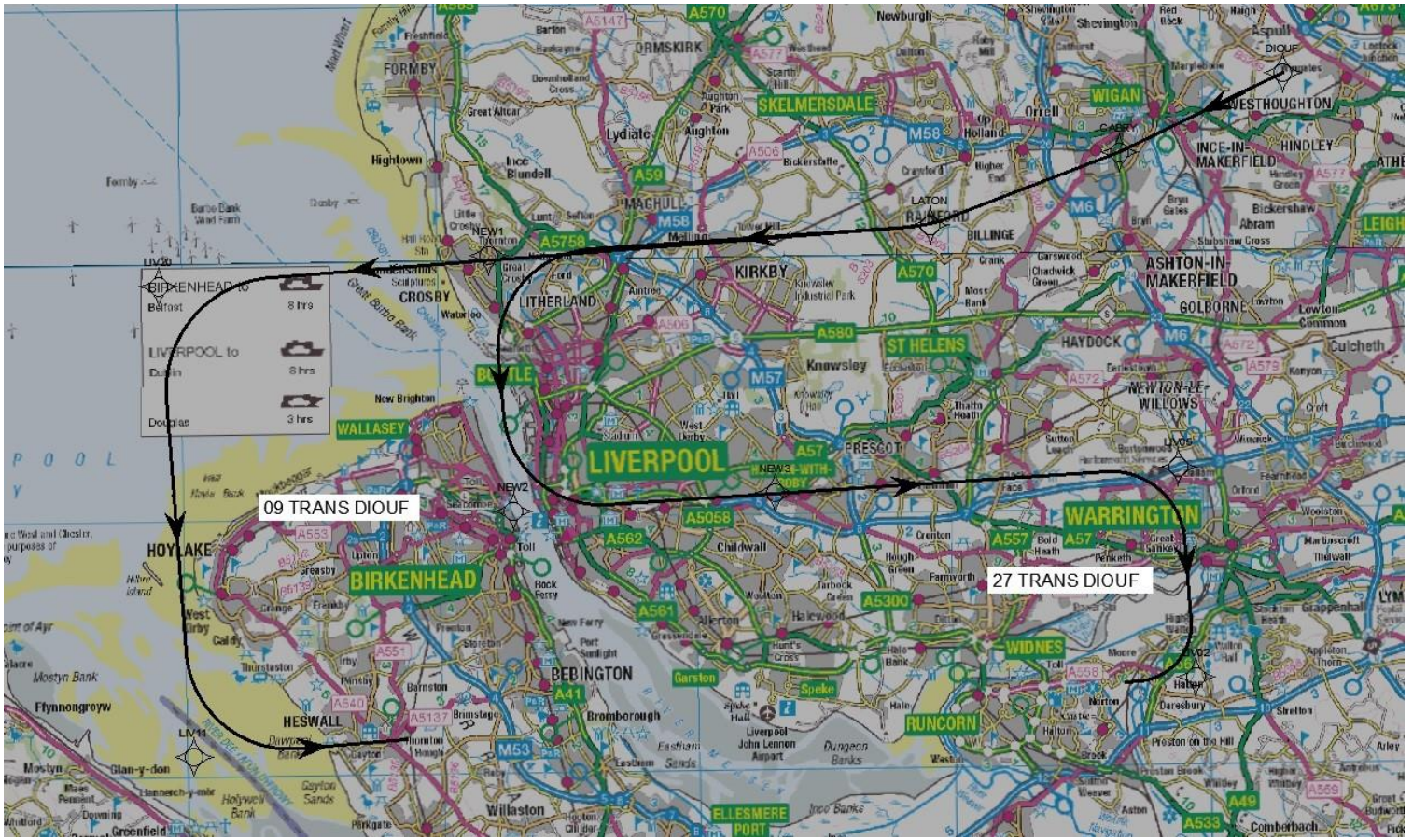
A1.6.2 Runway 09 SID CORKA Option 2



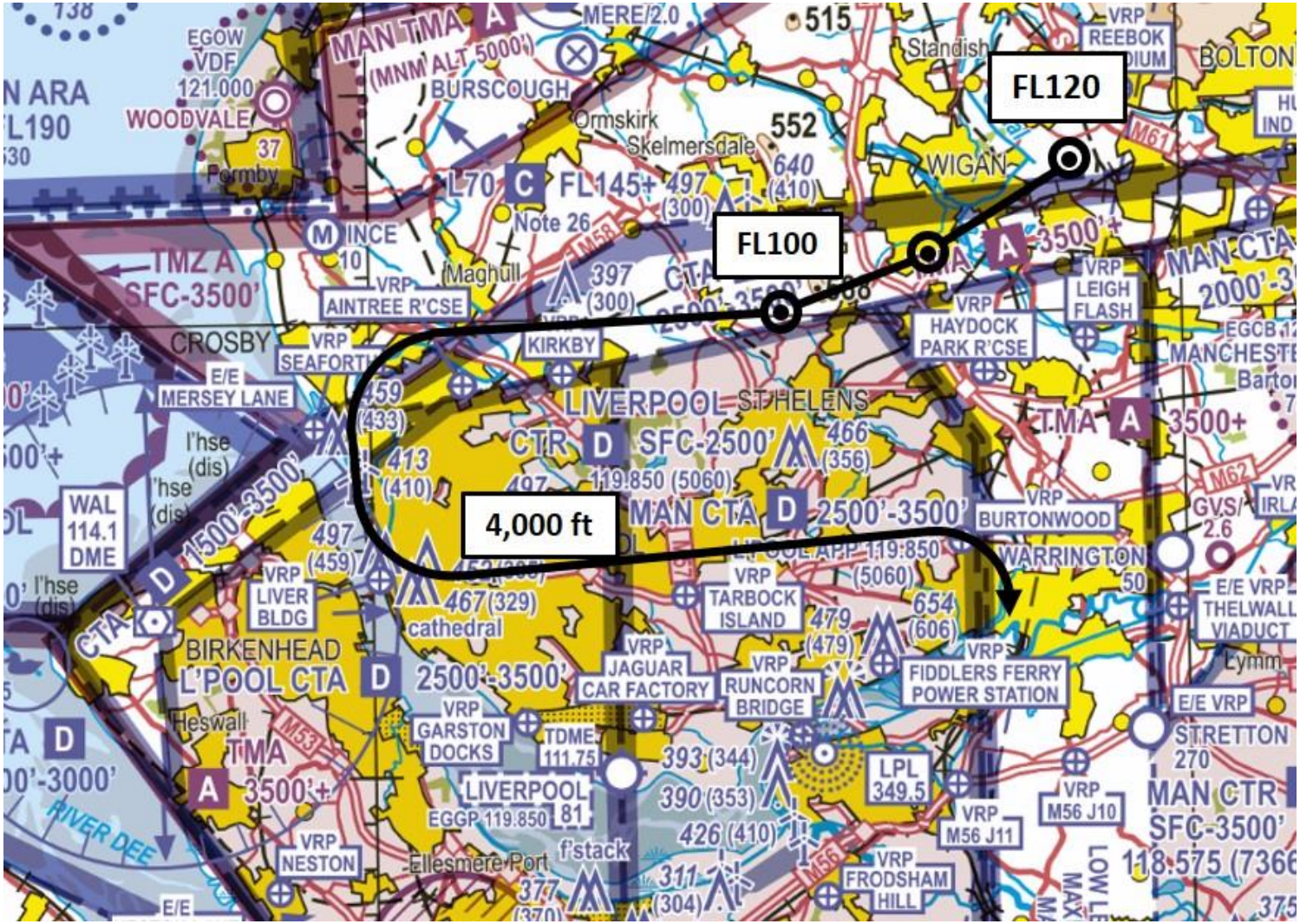
A1.6.3 Runway 09 SID CORKA Option 3

A2 Transition Procedures

A2.1 Transition DIOUF



A2.1.1 Transition DIOUF to Runway 27

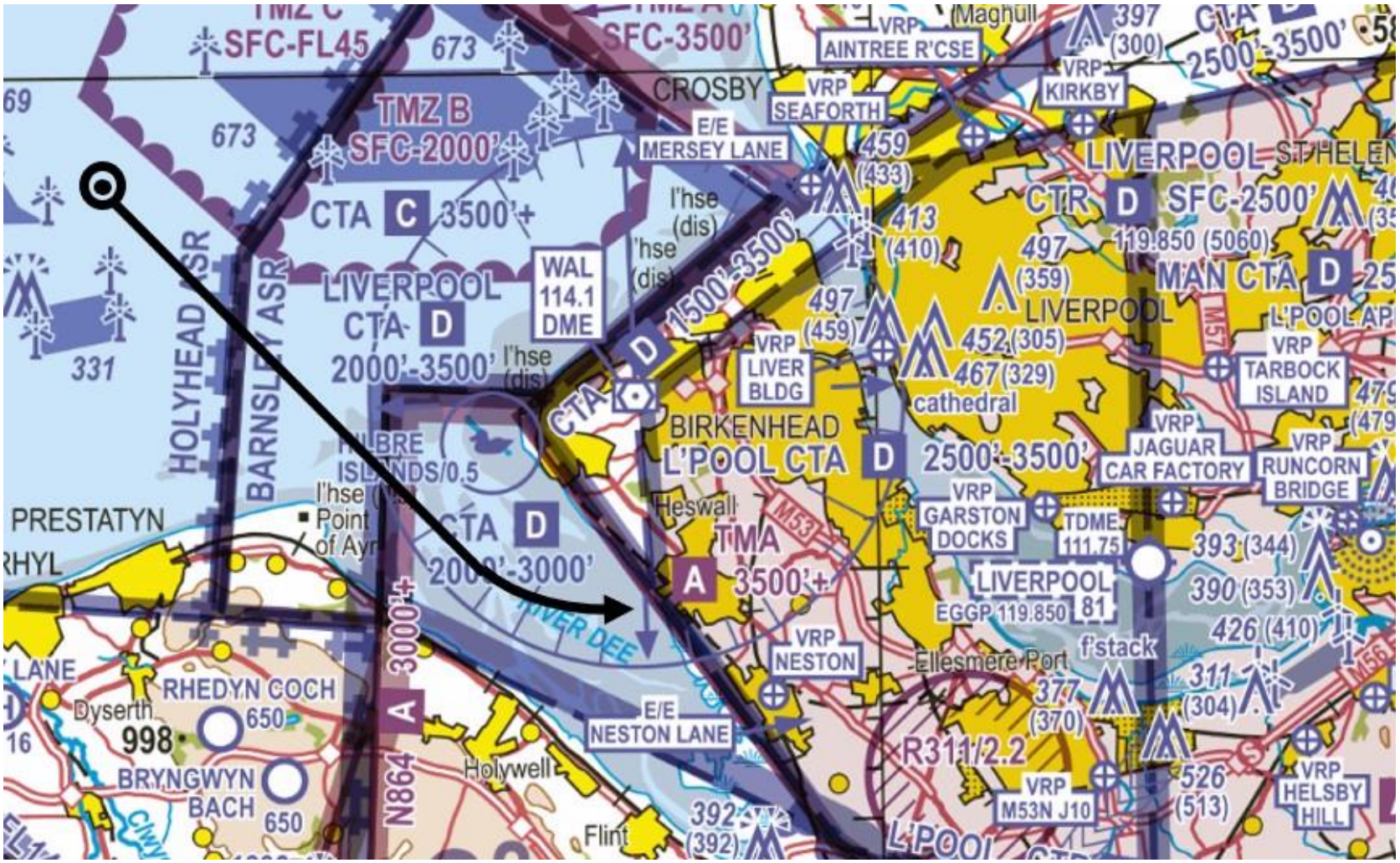


A2.1.2 Transition DIOUF to Runway 09

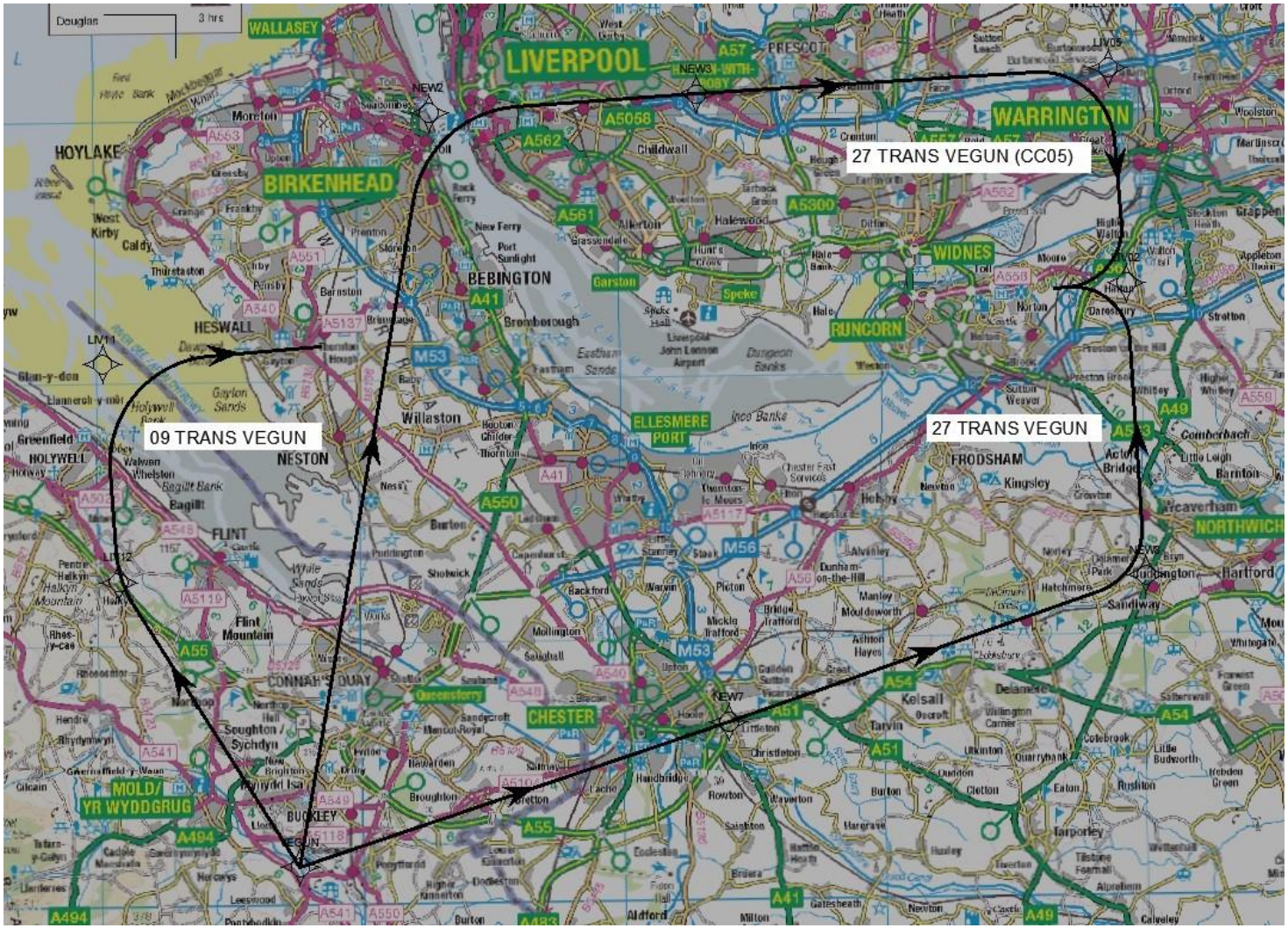
A2.2 Transition NOMSU

A2.2.1 Transition NOMSU to Runway 27

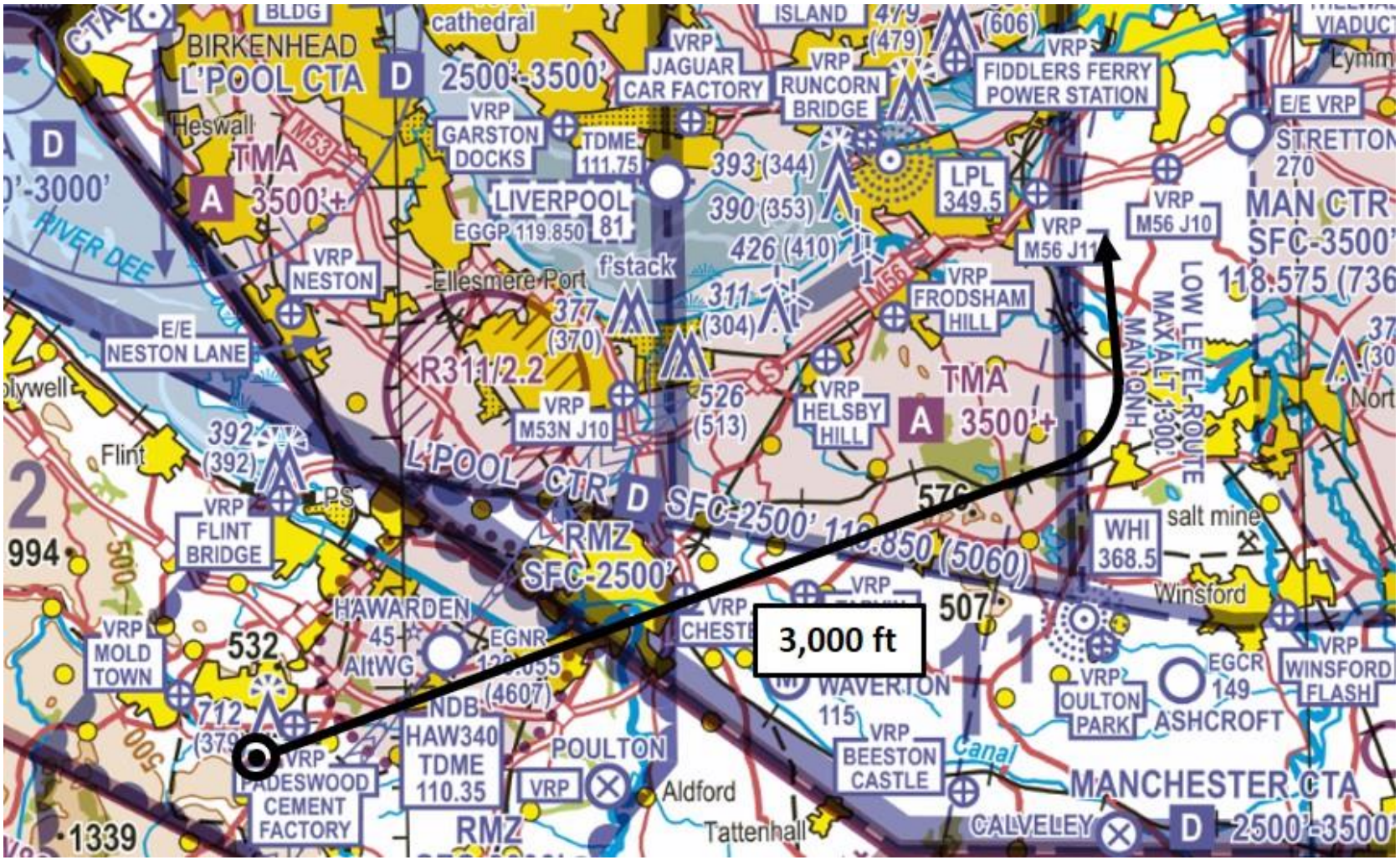
A2.2.2 Transition NOMSU to Runway 09



A2.3 Transition VEGUN



A2.3.1 Transition VEGUN to Runway 27

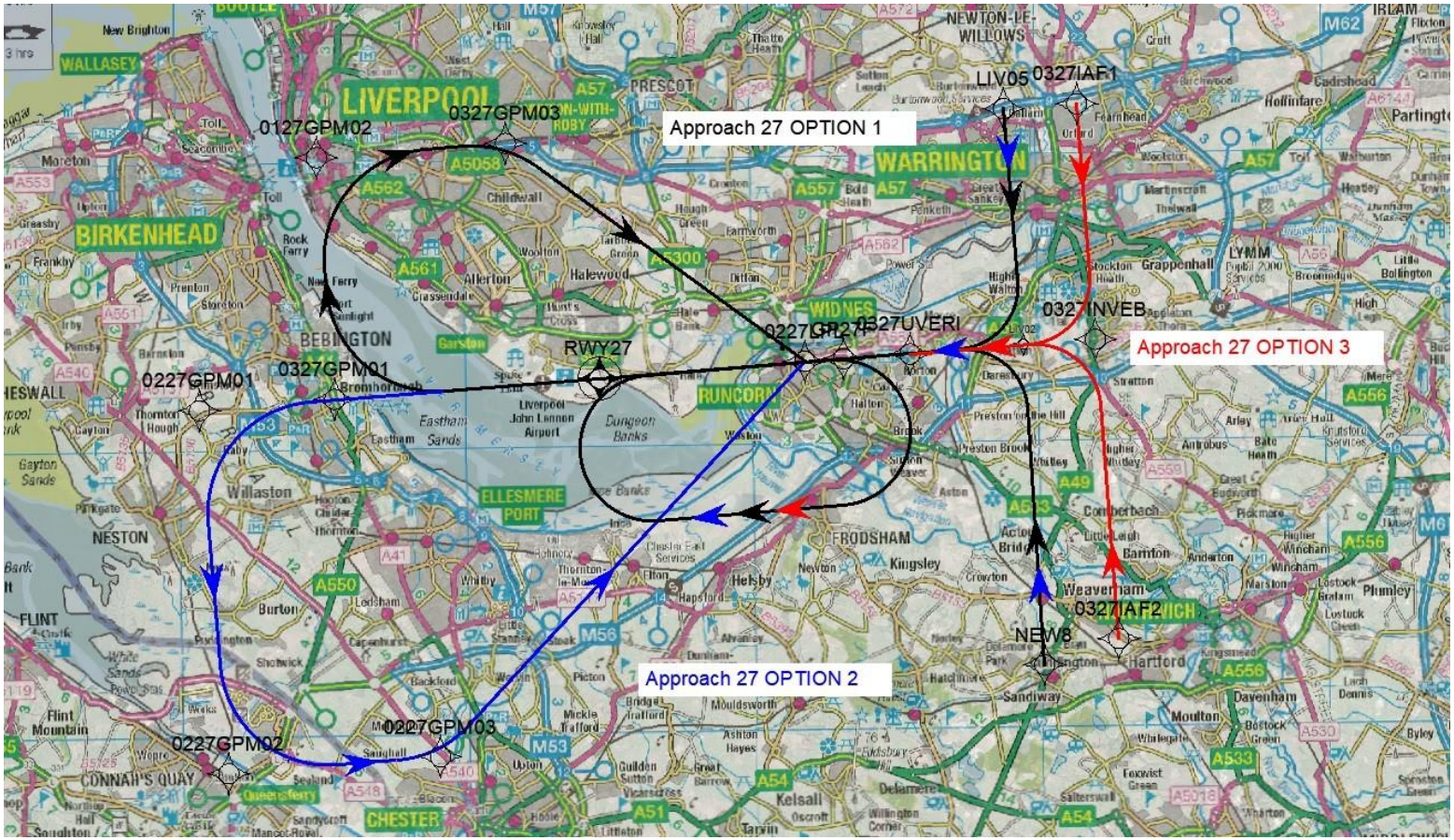


A2.3.2 Transition VEGUN (CC05) Runway 27

A2.3.3 Transition VEGUN to Runway 09

A3 Instrument Approach Procedures

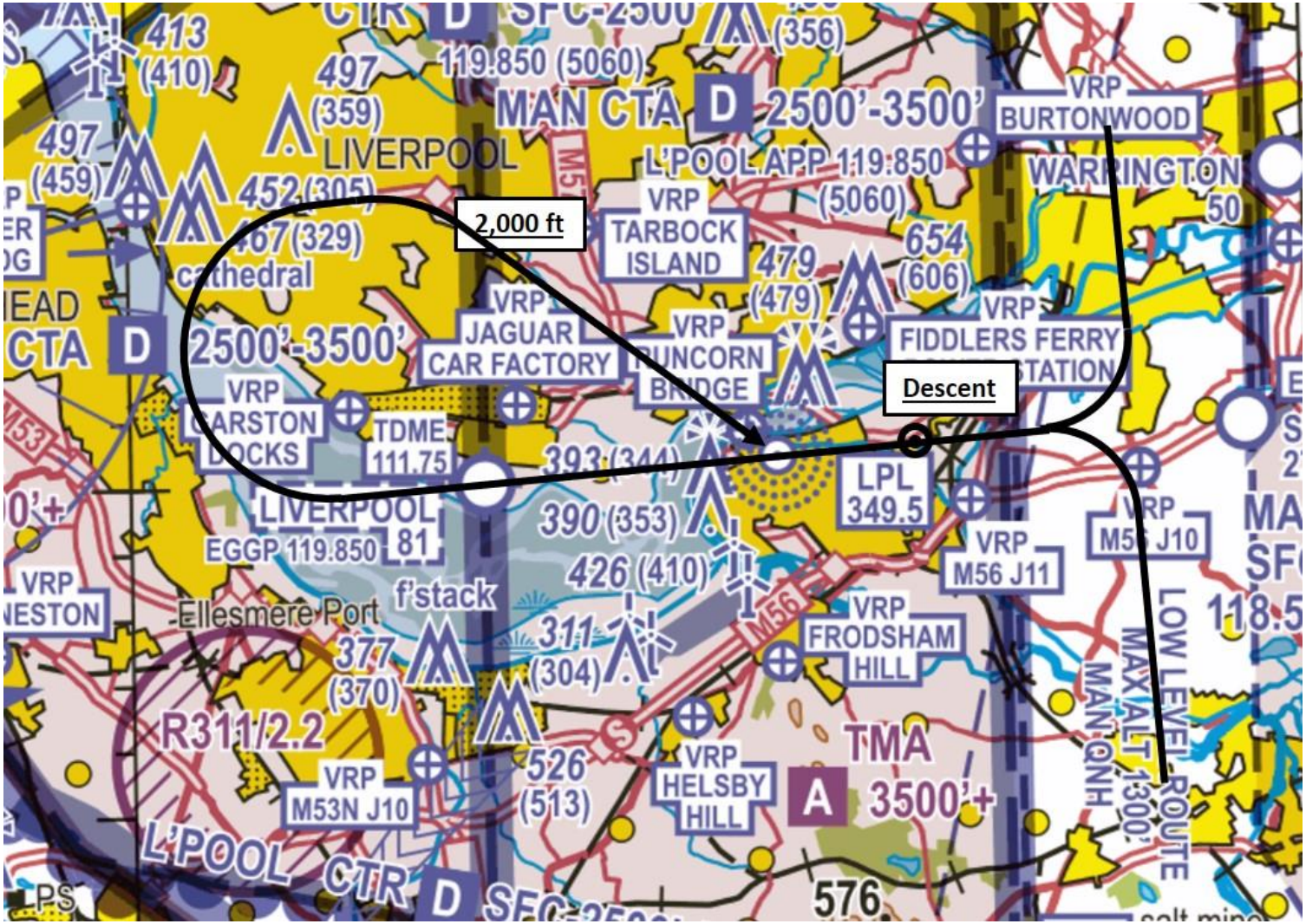
A3.1 Instrument Approach Procedure Runway 27



A3.1.1 Approach to Runway 27 Option 1

A3.1.2 Approach to Runway 27 Option 2

A3.1.3 Approach to Runway 27 Option 3

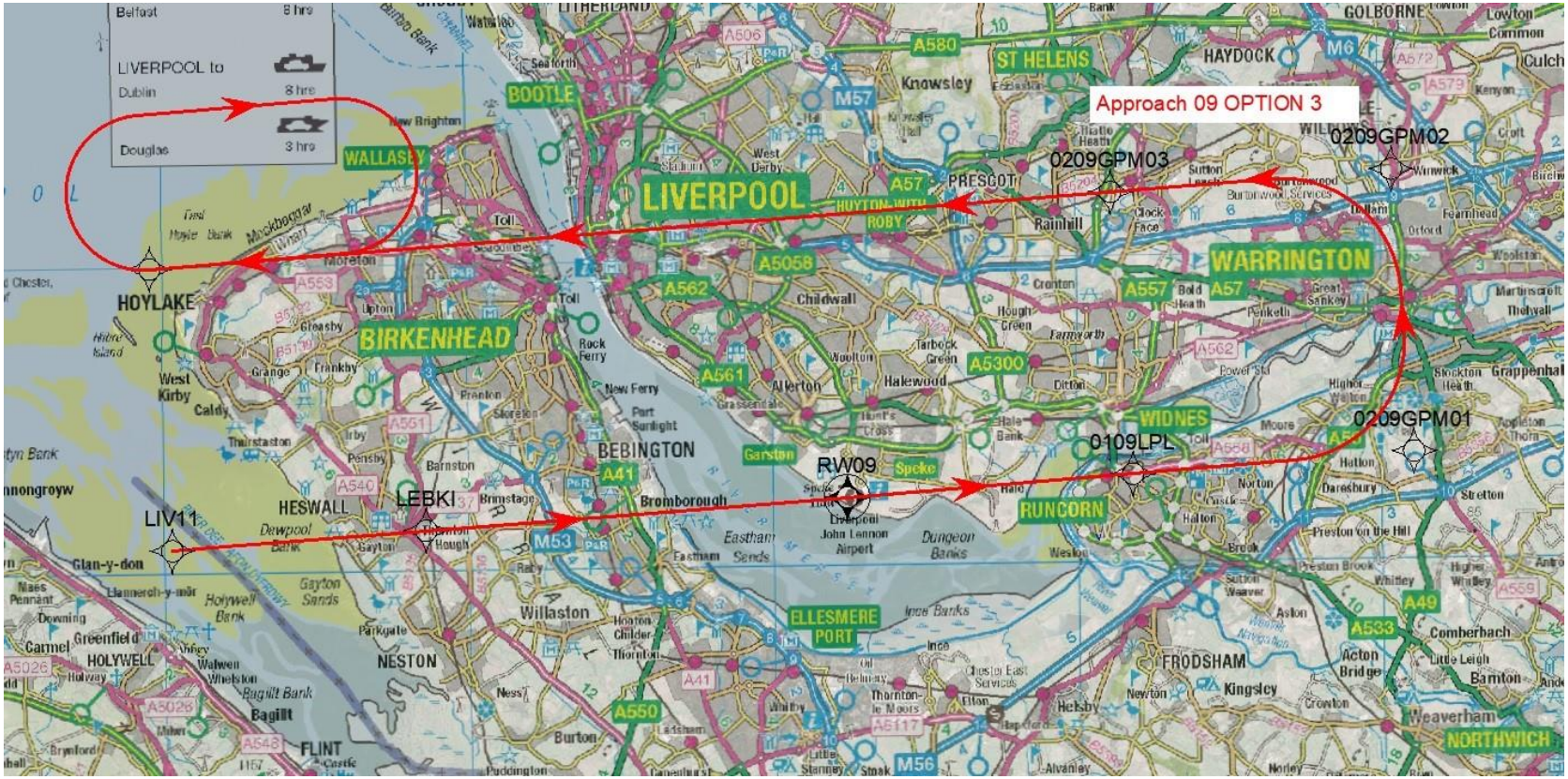


A3.2 Instrument Approach Procedure Runway 09

A3.2.1 Approach to Runway 09 Option 1

A3.2.2 Approach to Runway 09 Option 2

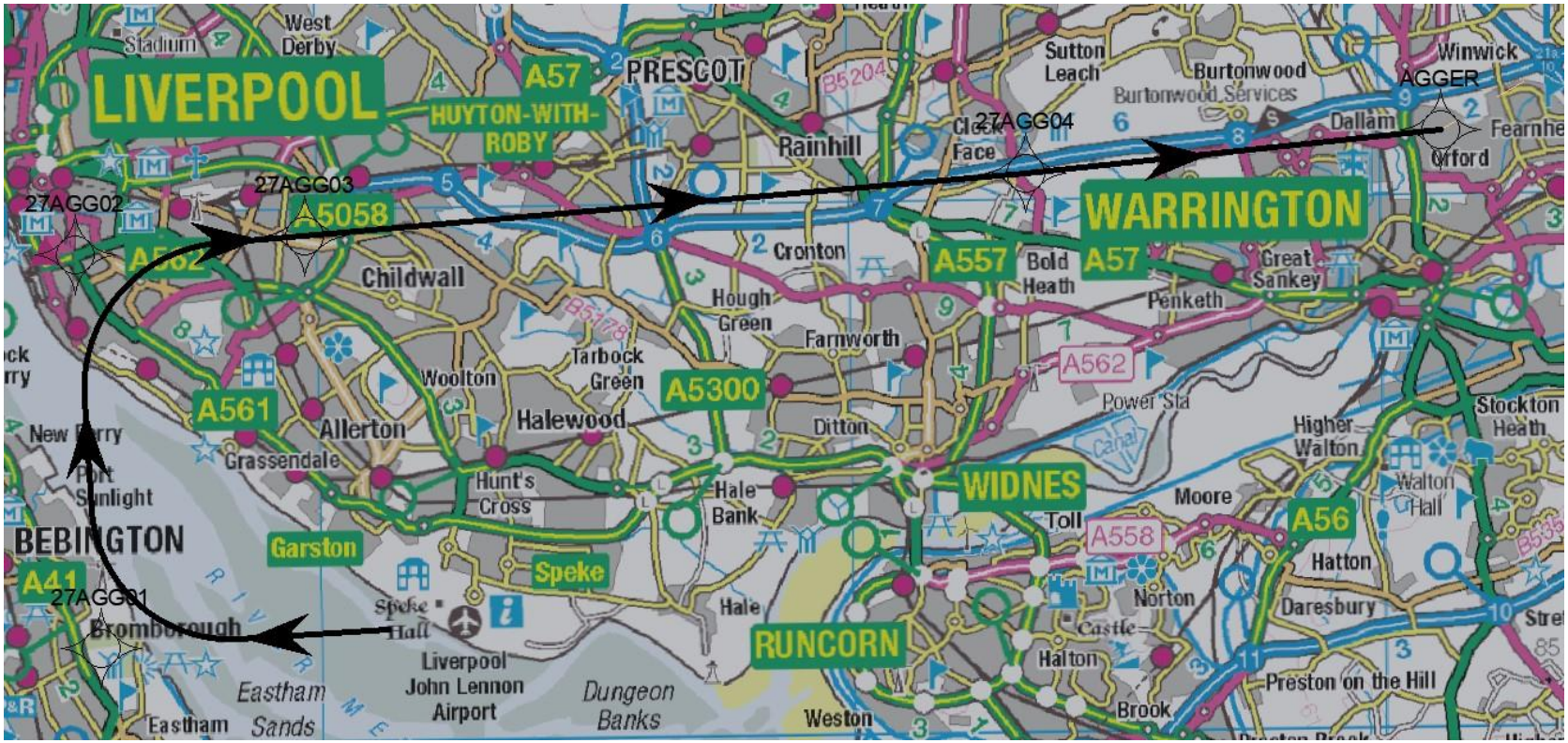
A3.2.3 Approach to Runway 09 Option 3 OS Map

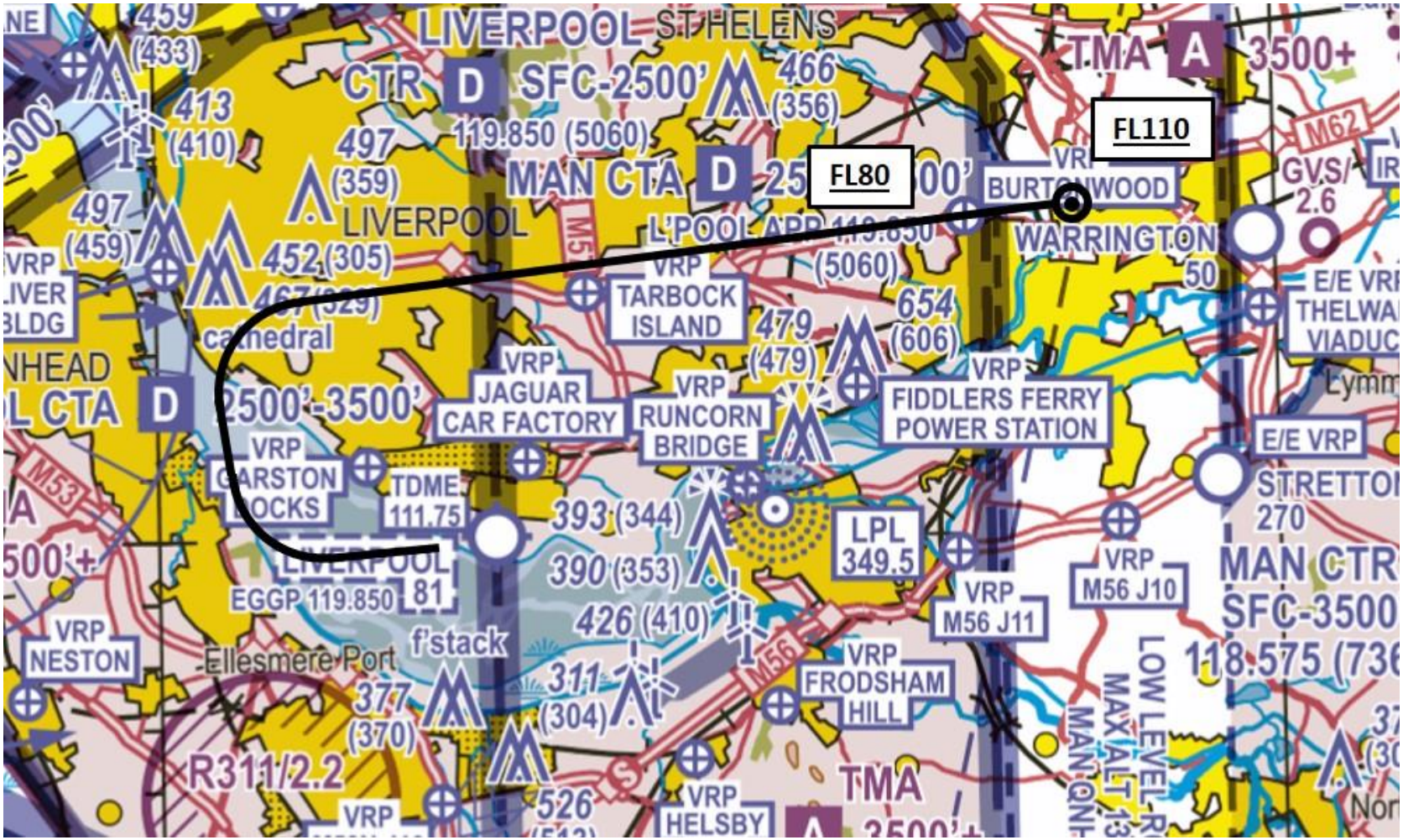


A3.2.4 Approach to Runway 09 Option 3 VFR Chart

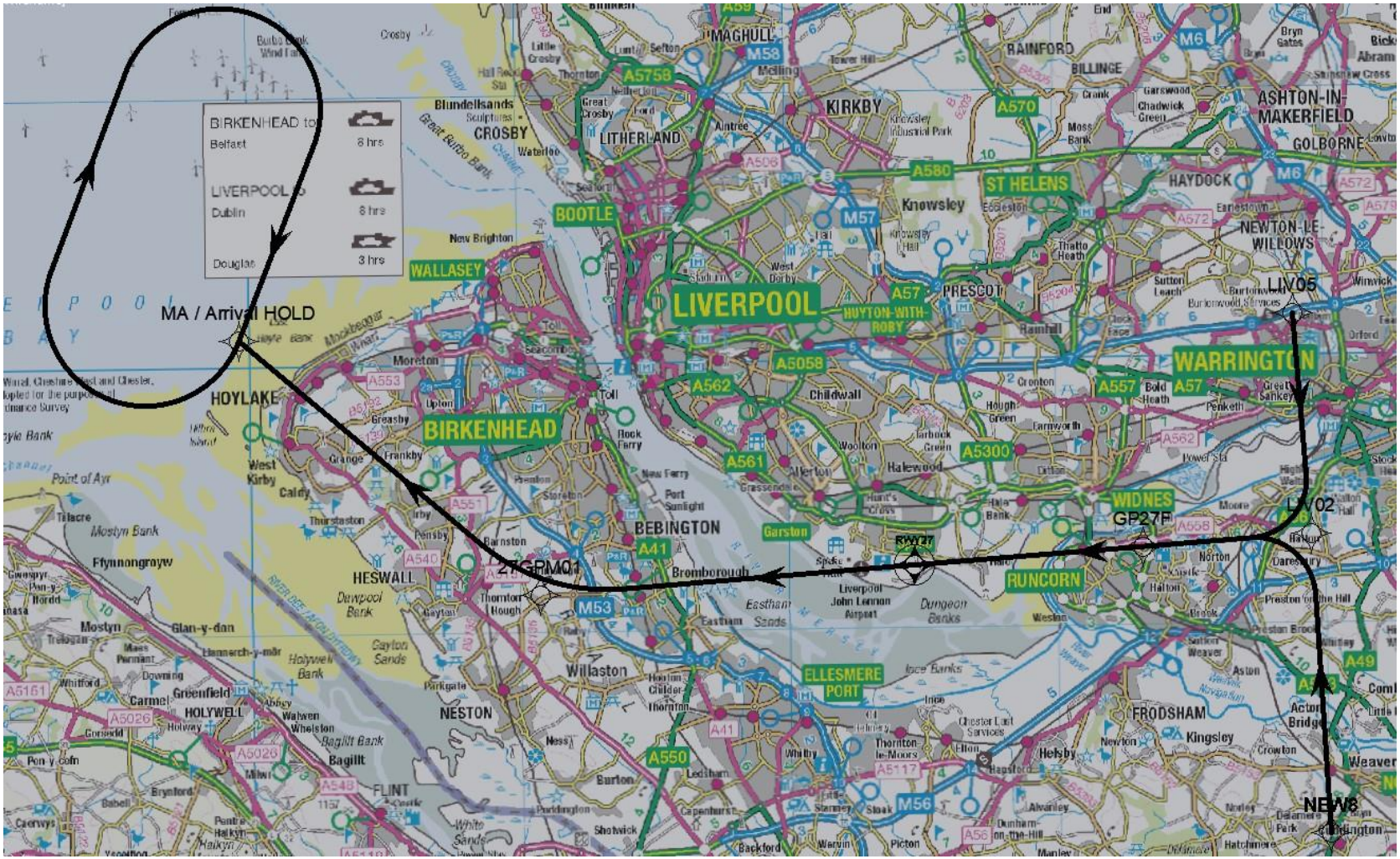
A4 Post Engagement Design Options

A4.1 Runway 27 SID AGGER Option 1b





A4.2 Instrument Approach Procedure Runway 27



A4.3 Instrument Approach Procedure Runway 09 Option 3b